SPECIAL PROVISIONS

DIVISION SB

BRIDGE 67564

S.P. 067-598-010

I hereby certify that the special provisions for the Bridge Construction (Division SB) contained in this Proposal were prepared by me or under my direct supervision and that I am a duly licensed professional engineer under the laws of the State of Minnesota.

John Sowada

9-14-2012 Lic. No. 45936

Date

SPECIAL PROVISIONS FOR S.P. 067-598-010

Bridge No. 67564
Rock County

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SB-1 GENERAL INSTRUMENTATION PLAN

SB-1.1 The Minnesota Department of Transportation (MnDOT) will be installing specialty geotechnical bridge instrumentation and monitoring equipment at this site as part of a performance monitoring program. The program will consist of several sensor technologies installed within the abutment embankment area and attached to or within the abutment embankments. The sensors will be provided by MnDOT and installed by MnDOT (or by a geotechnical consultant for MnDOT under a separate contract). This program will monitor and evaluate performance. Instrumentation may include: horizontal (or vertical) 'in-place' inclinometers, piezometers, earth pressure cells, strain gages, tiltmeters, optical survey reflectors or targets, and/or other measurement devices to monitor new and existing embankment performance (refer to the instrumentation and monitoring plans).

The Contractor will accommodate and coordinate the installation of the sensors and related equipment, providing incidental assistance as described in the special provisions. This will include, but is not limited to providing access to place sensors, casing, conduit, and equipment. The Contractor will provide openings for conduit to exit thru the wall system as described in the instrumentation drawings. The Contractor will also provide safe access to personnel for sensor installation, cable and conduit installation and protection, system installation, data collection, and inspection of the instrumentation as requested by the Project Engineer.

Additional assistance with activities including, but not limited to, minor earthwork (including creating protective soil cover mounds, or excavating sensor nests); trenching of sensors and conduit; placement of cables, and conduit; and minimizing construction activity in the installation areas during the sensor layout, and installation process will be provided and considered incidental to the work. Periodic access by lift or from ladders or similar, and/or related use of necessary safety equipment (i.e. for fall protection) is to be provided as needed for the efficient installation of monitoring targets or exterior mounted sensors.

Sensor installation activities are expected to take about 3 days including installing the horizontal/vertical deformation monitoring systems, attaching survey targets, and attaching strain gages and related stress/strain/pressure/tilt monitoring equipment and installing cable trenches, assembling protective conduit, making connections, and setting up the instrumentation data acquisition cabinet.

A pre-construction meeting will be held to coordinate details of the monitoring work to ensure coordination of activities. The instrumentation work will take place over a period several days, as the sensors will be placed at different times in the construction sequence. No compensation in addition to the Contract prices will be made to the Contractor for costs incurred by him, or because of any incidental delays to his forces or equipment as a result of this instrumentation work. It is anticipated that the instrumentation will be installed on multiple work days as construction progresses. The

contractor should build appropriate time in to the schedule for incidental assistance and allowing MnDOT or the instrumentation contractor to perform work in portions of the project area without active construction in those areas.

SB-1.2 The Contractor will take necessary precautions to protect and not to damage the performance monitoring instruments during the bridge construction process; special requirements for soil compaction near embedded instrumentation may be required. Any instrumentation that is damaged by the contractor due to negligence will be replaced at the Contractor's expense (note that instruments are not "off the shelf" items, and project delays may result from sensor damage). The Engineer may stop work in the vicinity of the damaged instruments to provide an opportunity for removal and replacement.

SB-1.3 The Sensor locations and cable runs will be coordinated to ensure that all monitoring systems are protected from construction activities and may remain operable and in-place from the time of installation through the completion of the work.

SB-2 (1601) SOURCE OF SUPPLY AND QUALITY

The provision of MnDOT 1601 are supplemented as follows:

The Contractor will furnish and use only steel and iron materials that have been melted and manufactured in the United States in executing the work under this Contract, in conformance with the provisions of the U.S. Code of Federal Regulations 23CFR635.410. Domestic products taken out of the United States for any process (e.g. change of chemical content, permanent shape or size, or final finish of product) shall be considered foreign source materials.

All bids must be based on furnishing domestic iron and steel, which includes the application of the coating, except where the cost of iron and steel materials incorporated in the work does not exceed one-tenth of one percent of the total Contract cost or $2,500.00, whichever is greater. The state may approve the use of foreign iron and steel materials for particular Contract items, provided the bidder submits, a stipulation identifying the foreign source iron and/or steel product(s) and the estimated invoice cost of the product(s), for one or more of the Contract bid items. Each stipulation shall be made on the "Stipulation for Foreign Iron or Steel Materials" form which shall be submitted with the Contractor's proposal. **If the Contractor chooses to use ANY non-domestic iron or steel, the Contractor must submit a stipulation**. The Contractor may use one of the following means to submit their stipulation:

1. Submit the stipulation form within the proposal.
2. If the Contractor submits a "Two Way Electronic Bid" as described in MnDOT 1206, the completed chart must be submitted to MnDOT prior to the bid opening and no later than 9:30 A.M. on the day of the bid opening.

a) The stipulation may be faxed to Nancy Boeve at 651-366-4248.
b) E-Mail the form to biddocsubmittal.dot@state.mn.us, place the State Project number in the subject line
c) The stipulation may be mailed or otherwise delivered to Nancy Boeve, 395 John Ireland Boulevard, M.S. 650, ST. Paul, MN 55155.

The "Stipulation for Foreign Iron or Steel Materials" form is attached or can be found on the MnDOT Web site: http://www.dot.state.mn.us/bidlet/forms.html.

Prior to completing work the Contractor shall submit to the Engineer a certification stating that all iron and steel items supplied are of domestic origin, except for non-domestic iron and steel specifically stipulated and permitted in accordance with the paragraph above.

Source of Supply and Quality: MnDOT 1604 is supplemented as follows: All costs of shop inspection at plants outside the United States shall be borne by the Contractor. Such costs shall be deducted from monies due or to become due the Contractor.

Partial Payment: All provisions for partial payments shall apply to domestic materials only. No payments shall be made to the Contractor for materials manufactured outside of the United States until such materials have been delivered to the job site.

Alternate Bidding Process. Unless an alternate bidding process is specified, use of foreign steel and iron products in quantities in greater than provided above is not permitted. When the alternate bidding process is permitted the Contract may be awarded to the bidder who submits the lowest total bid based on furnishing domestic iron or steel unless such total bid exceeds the lowest total bid based on foreign materials by more than 25 percent.

SB-3 (1706) EMPLOYEE HEALTH AND WELFARE

The provisions of MnDOT 1706 are supplemented as follows:

SB-3.1 The Contractor shall submit a plan, at the preconstruction conference, for providing all OSHA required safety equipment (safety nets, static lines, false decks, etc.) for all work areas whose working surface is 1.8 meters (6 feet) or more above the ground, water, or other surfaces. Submittal of this plan will in no way relieve the Contractor of his/her responsibility for providing a safe working area.

All safety equipment, in accordance with the Contractor's plan, must be inplace and operable in adequate time to allow MnDOT personnel to perform their

required inspection duties at the appropriate time. No concrete shall be placed in any areas affected by such required inspection until the inspection has been completed.

The installation of safety lines, safety nets, or other systems whose purpose is to reduce the hazards of bridge work may require the attachment of anchorage devices to beams, girders, diaphragms, bracing or other components of the structure. Clamp type anchorage systems which do not require modification of structural members may be used provided they do not interfere with proper execution of the work; however, if the Contractor desires to use an anchorage system which requires modification of structural members, s/he shall request approval, in writing, for plan modification as provided in MnDOT Specifications. Requests to install systems which require field welding or drilling of primary stress carrying members of a bridge will not be approved. The Contractor shall indicate any portions of anchorage devices which will remain permanently in the structure.

On both ends of each pier cap extending 1.8 meters (6 feet) or more above the ground, the Contractor shall install an insert or other suitable anchorage to which safety lines can be attached. Any portion of said device extending outside the finished lines of the pier cap shall be removed unless otherwise approved by the Engineer. Any void or cavity resulting from the installation or removal of this device shall be repaired or sealed to prevent the ponding or entry of water as directed by the Engineer.

Approved anchorage systems shall be furnished, installed, and removed at no increased cost to the State for materials, fabrication, erection, or removal of the bridge component or anchorage system.

SB-4 (1717) AIR, LAND AND WATER POLLUTION

The provisions of 1717 are supplemented as follows:

The Contractor's attention is hereby directed to MPCA Rule 7011.0150 as it relates to sandblasting and/or concrete removal operations (http://www.pca.state.mn.us/index.cfm).

The Contractor shall contain waste materials on the project site and provide for their handling, storage, transportation and disposal in accordance with Minnesota Pollution Control laws and regulations. The Contractor shall document the storage, transfer and disposal of waste materials in accordance with the MnDOT Environmental Services publication titled "Removing Paint from Bridge Steel Structures", a current copy of which is available at http://www.dot.state.mn.us/environment then go to publications, then into "Removing Paint (Dry Abrasive Blasting) from Bridge Steel Structures". Waste materials are defined as paint overspray and drippings, used paint pails, rags, spent solvents, cleaning solutions, and other related debris from cleaning operations including spent

abrasive materials or paint chips. Painting, and all work associated therewith, shall be so conducted as to preclude waste materials from falling upon public waters.

It is the responsibility of the Contractor to provide the following safeguards at all times during cleaning and painting operations. All safeguards shall be in place and operable before cleaning and painting operations begin.

A. Primary safeguards such as containment (curtains and floor coverings), together with adequate structural support such as scaffolding or rope nets, shall be utilized to contain waste materials in the work area. Catchment systems shall be emptied as often as necessary to maintain their structural integrity.

B. Safeguards such as floating booms, mats of absorbent material, skimmers, or similar systems shall be placed in streams to avoid nuisance conditions in the stream caused by cleaning or painting operations.

C. Locked storage of cleaning and painting materials to prevent access by vandals.

Cleaning and painting operations shall be suspended during periods when unfavorable weather conditions may reduce the effectiveness of the above noted safeguards. In situations where use of some of the safeguards listed are not feasible, other innovative safeguards shall be employed. Emphasis shall be placed on containment of waste materials rather than placing reliance on safeguards such as booms, straw dams, skimmers, or absorbent mats. These shall be considered backup systems to guard against water pollution which may result from the failure of primary safeguards.

Materials such as paint chips and sand which are readily recoverable from bridge decks or stream banks, empty paint pails, and rags and debris from cleaning operations shall be disposed of in a proper manner. Paint chips and spent sand shall be removed from the bridge deck on a daily basis and in an approved manner. Recoverable sand and paint chips from blasting operations may be recycled, but the ultimate disposal shall be to an appropriate waste facility. Spent aqueous cleaning solutions shall be discharged to a recognized sewage collection and treatment system. Spent solvents and cans or pails containing waste paint shall be taken to an incinerator approved by the MPCA for disposal, or to an MPCA approved hazardous waste storage area.

In the event of an accidental loss of painting or cleaning materials or debris into public waters, the Contractor shall take immediate action to recover the lost materials, and the incident shall be promptly reported by telephone to the State Duty Officer at 1-800-422-0798 followed by a written report addressed to MPCA, Water Quality Division, Compliance and Enforcement Section, 520 Lafayette Road, St. Paul, Minnesota, 55155.

Unless otherwise provided in these special provisions, construction, demolition and/or removal operations conducted over or in the vicinity of public waters shall be so controlled as to prevent materials from falling into the water. Any materials which do fall into the water, or onto areas where there is a likelihood that they will be picked up by rising water levels, shall be retrieved and stored in areas where such likelihood does not exist.

SB-5 IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

By signing this proposal, the bidder will be deemed to have stipulated as follows:

(a) That any facility to be utilized in the performance of this Contract, unless such contract is exempt under the Clean Air Act, as amended (42 U.S.C. 1857 et. seq., as amended by Pub. L. 91-604), and under the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et. seq., as amended by Pub. L. 92-500), Executive Order 11738, and regulations in implementation thereof (40 CFR, Part 15), is not listed on the U.S. Environmental Protection Agency (EPA) List of Violating Facilities pursuant to 40 CFR 15.20.

(b) That Rock County shall be promptly notified prior to contract award of the receipt by the bidder of any communication from the Director, Office of Federal Activities, EPA, indicating that a facility to be utilized for the contract is under consideration to be listed on the EPA List of Violating Facilities.

SB-6 (1806) DETERMINATION AND EXTENSION OF CONTRACT TIME

The Contract Time will be determined in accordance with the provisions of 1806 and the following:

SB-6.1 Construction operations shall be started on April 1, 2013 or earlier as determined by the County after the date of Notice of Contract Approval. Construction operations shall not commence prior to Contract Approval or being approved by the County.

SB-6.2 When, in the opinion of the Engineer, work on the Project cannot be performed due to failure of material delivery beyond the control of the Contractor, the Engineer agree to a Suspension of Work in conformance with MnDOT 1803.4 and/or will cease the charging of working days, whichever the Engineer deems applicable.

A Resumption of Work Order will be issued by the Engineer after the Contractor has received delivery of the required material, and/or the Engineer will resume the charging of Working Days.

SB-6.3 Within 15 days after the date of mailing to the Contractor of a notice that the Contract has been approved unless the Contractor and the County agree to a different schedule, the Contractor shall furnish evidence to the Engineer that the Contractor has placed orders for all material. The Contractor shall furnish a list of material and equipment suppliers and proposed delivery dates. Any items to be used from the Contractor's stock shall be noted. Also see 2405 (SB-17) for prestressed beam requirements.

SB-7 (1904) EXTRA AND FORCE ACCOUNT WORK

The provisions of MnDOT 1904 are supplemented and/or modified with the following:

SB-7.1 The Contractor is required to submit force account work itemized statements of costs in accordance with MnDOT 1904 to the Engineer on MnDOT form TP-21659 (Summary of Daily Force Account). Copies of this form can be obtained from the Engineer.

SB-7.2 The following sentence shall be added to the second paragraph of MnDOT 1904:

> "Under no circumstance will the negotiated unit price for Extra Work which is performed by a subcontractor include a Prime Contractor allowance which exceeds that provided for in 1904(4), Paragraph 3."

SB-8 (2021) MOBILIZATION

The provisions of MnDOT 2021 are hereby deleted and replaced with the following:

SB-8.1 DESCRIPTION

Mobilization shall consist of preparatory work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies and incidentals to the Project site; for the establishment of all Contractor's offices and buildings or other facilities necessary for work on the Project. Mobilization may include bonding, permit, and demobilization costs. When the proposal does not have a lump sum item for Mobilization, all costs incurred by the Contractor for Mobilization shall be incidental to other work.

SB-8.2 BLANK

SB-8.3 BLANK

SB-8.4 BLANK

SB-8.5 BASIS OF PAYMENT

Based on the lump sum Contract price for mobilization, partial payments will be made as follows:

Mobilization Partial Payments		
% of Original Contract Amount Completed[1]	Pay Lesser of the Two	
	% of Mobilization	% of Original Contract Amount
5	50	3
15	75	5
25	100	5
95	100	N/A

[1] The Percent of Original Contract Amount Completed = the amount earned by the Contractor, excluding money earned for mobilization and material on hand, divided by the total value of the original contract (all bid items).

The total sum of all payments shall not exceed the original Contract amount bid for the mobilization item, regardless of the fact that the Contractor may have, for any reason, shut down work on the Project or moved equipment away from the Project and then back again.

Nothing herein shall be construed to limit or preclude partial payments otherwise provided by the Contract.

Item No.	Item	Unit
2021.501	Mobilization	Lump Sum

SB-9 (2105) EXCAVATION AND EMBANKMENT

Roadway excavation and embankment shall be performed in accordance with the provisions of 2105, except as modified below:

All topsoil shall be stripped prior to excavation and stockpiled. Should the Contractor choose to stockpile outside of the construction limits, he shall make all necessary arrangements with the adjoining property owners at his own initiative prior to the work. In replacing the topsoil, the Contractor shall replace all material removed as uniformly in depth as possible, and ditch bottoms and backslopes within the permanent right-of-way with a minimum of 3". Following replacement, the topsoil shall be given a final

harrowing or springtoothing to a depth of not less than 2" to assure friability. Payment for all topsoil related work shall be included in the unit bid price for Item No. 2401.601 Structure Excavation.

The Contractor shall be responsible for obtaining permission from adjoining property owners for any encroachments onto property not covered by construction limits as shown in the project plans.

Side slopes and end slopes of embankments shall be constructed as nearly as practicable to the slope lines as staked by the Engineer.

The embankment shall be compacted by the Quality Compaction Method.

The finishing operations shall be governed by the provisions of 2105.3G and 2112 except as may be amended herein.

Prior to acceptance of any section of the roadbed, the roadbed shall be given a final shaping to the extent necessary to obtain reasonably close conformity with the grades staked by the Engineer and the cross sections shown in the plans.

SB-10 (2105) SELECT GRANULAR BORROW 10% (CV)

Reinforced backfill (Select Granular Borrow 10% (CV)) shall be used in all beam seat zones, bearing bed zones, and GRS zones as shown on the Plans.

Select Granular Borrow Mod 10% for use as abutment and/or wingwalls shall be in accordance with MnDOT 3149.2B, and shall be installed in accordance with MnDOT 2105 and the plans. MnDOT 3149.2B shall be modified so that the ratio of the portion passing the #200 sieve divided by the portion passing the 1 inch sieve shall not exceed 10% by mass.

Compaction shall be achieved by the "Specified Density" Method described in MnDOT 2105.3F1 or as directed by the Engineer.

All backfill used within the reinforced zone shall have a pH of 4.5 to 10 as determined by AASHTO Procedure T-289. Prior to placement of the backfill, obtain and furnish to the engineer certified test results that the backfill material complies with the requirements of this specification.

The minimum value of the angle of internal friction of the wall backfill material shall be 39 degrees. The friction angle shall be determined using the wall backfill and a large shear box (minimum dimension 12 inches) and ASTM D-3080 with confining pressures of 7.5 psi, 15 psi and 30 psi and compacted to a dry density of 95.0 percent of the maximum dry density as determined by AASHTO T-99.

The gradation shall meet the following requirements:

Aggregate Size	% passing
¾"	100
½"	85-100
No. 4	10-50
No. 50	0-5

SB-10.1 Approval

The Contractor shall select a reinforced backfill from a MnDOT certified pit meeting all specifications described above, along with corresponding testing documentation and related material specifications for the elected material for the approval of the Engineer.

SB-10.2 Basis of Payment

All work performed including all materials, work, testing and incidentals as described above shall be considered an incidental expense to the price bid for "Select Granular Borrow Mod. 10% (CV)."

SB-11 (2105) GEOSYNTHETIC REINFORCEMENT

SB-11.1 GENERAL REQUIREMENTS

All geosynthetic reinforcement used on the project shall be of a type listed on the MnDOT Approved Products List as approved by the Engineer.

Geosynthetic Reinforcement Type 1 supplied as reinforcing members for bearing bed zone, GRS zone and wingwalls shall be a woven polypropylene with a minimum wide width tensile strength (ASTM 4595 (geotextiles) and ASTM 6637 (geogrids)) of 5,300 lb/f. The test should be performed at a strain of 10 percent per minute. The wide width tensile strength (ASTM D4595) at a strain of 2 percent shall be greater than 1,514 lb/ft.

Geosynthetic Reinforcement Type 2 supplied as reinforcing members and wrapping of the RSF, beam seat zone and integrated approach zone shall be a woven polypropylene with a minimum wide width tensile strength (ASTM 4595 (geotextiles)) of 4,800 lb/f. The test should be performed at a strain of 10 percent per minute. The wide width tensile strength (ASTM D4595) at a strain of 2 percent shall be greater than 900 lb/ft.

All geosynthetic reinforcement shall be furnished in a protective wrapping that shall prevent exposed to ultraviolet radiation and damage from shipping or handling. During all periods, of shipment and storage, the filter fabric shall be protected

from direct sunlight, ultraviolet rays and temperatures greater than 140 degrees Fahrenheit. To the extent possible, the fabric shall be maintained and wrapped in its protective covering. The geosynthetic reinforcement shall be kept dry until installed. Each roll shall be clearly marked to identify the material contained.

SB-11.2 INSTALLATION

Install geosynthetic reinforcement in accordance with geosynthetic manufacture's recommendation and shop drawings.

1. Orient geosynthetic reinforcement with the highest strength axis perpendicular to the wall face.

2. Prior to geosynthetic reinforcement placement, place the backfill and compact to the elevation of the top of the wall units at the elevation of the geosynthetic reinforcement.

3. Place geosynthetic reinforcement at the elevation and to the lengths shown on the Plans.

4. Lay geosynthetic reinforcement horizontally on top of the concrete retaining wall units and the compacted backfill soils. Place the geosynthetic reinforcement within one inch of the face of the Concrete masonry units. Place the next course of concrete masonry units on top of the geosynthetic reinforcement.

5. The geosynthetic reinforcement shall be in tension and free from wrinkles prior to placement of the backfill soils. Pull geosynthetic reinforcement hand-taut and secure in place with staples, stakes, or by hand-tensioning until the geosynthetic reinforcement is covered by 6 inches of loose fill.

6. The geosynthetic reinforcements shall be continuous throughout their embedment lengths. Splice in the geosynthetic reinforcement strength direction are not allowed.

7. Do not operate tracked construction equipment directly on the geosynthetic reinforcement. At least 6 inches of compacted backfill soil is required prior to operation of tracked vehicles over the geosynthetic reinforcement. Keep turning of of tracked construction equipment to a minimum.

8. Rubber-tired equipment may pass over the geosynthetic reinforcement at speeds of less than 5 miles per hour. Turning of rubber-tired equipment is not allowed on geosynthetic reinforcement.

SB-11.3 INSPECTION

Immediately prior to placing the geosynthetic reinforcement and CMU's the prepared area shall be inspected by the Engineer in the field.

Areas on which geosynthetic reinforcement and concrete masonry units are to be placed shall be constructed to the lines and grades shown on the Plans, and as approved by the Engineer.

SB-12 (2211) AGGREGATE BASE

The aggregate base shall be constructed in accordance with the provisions of 2211, except as modified below:

The aggregate shall conform to the requirements of 3138 for the Class shown in the Plans and meet the Soil Conditions for the RSF shown in the Plans.

The aggregate base shall be compacted by the Quality Compaction Method.

Aggregate Base Type Class 5 Modified shall used to construct the reinforced soil foundation (RSF) and the integrated approach zone.

SB-13 (2357) BITUMINOUS TACK COAT

Bituminous tack coat shall be constructed in accordance with the provisions of 2357, except as modified below:

SB-13.1 The bituminous material for tack coat shall be CRS-1.

SB-14 (2360) PLANT MIXED ASPHALT PAVEMENT

Mix Designation Numbers for the bituminous mixtures on this Project are as follows:

Type SP 12.5 Wearing Course Mixture (2,B) - SPWEB240B

Mix Designations for bituminous mixtures contain the following information:

(1) The first two letters indicate the mix type.
SP = Gyratory Mixture Design

(2) The third and fourth letters indicate the course:
WE = Wearing and Shoulder Wearing Course
NW = Non-Wearing Course

(3) The fifth letter indicates the aggregate size:
B or 3 = 19.0 mm (3/4 inch), SP 12.5 mm (1/2 inch)

(4) The sixth digit indicates the Traffic Level (ESAL's x 10^6)

(5) The last two digits indicate the air void requirement (i.e. 40 = 4.0% air voids).

(6) The letter after the mix designation identifies the performance grade of asphalt cement.
A = PG52 - 34
B = PG 58 - 28
C = PG 58 - 34
D = PG 58 - 40
E = PG 64 - 28
F = PG 64 - 34
G = PG 64 - 40
H = PG 70 - 28
I = PG 70 - 34
L = PG 64 - 22

Pavement smoothness requirements of 2360.7C **will not** apply on this Project. The requirements of 2360.7B (Surface Requirements) **will** apply.

Payment for plant mixed asphalt surface will be made on the basis of the following schedule:

Item No.	**Item Unit**
2360.501 Type SP (1) Wearing Course Mixture ((3),(4))	metric ton **[ton]**
2360.502 Type SP (1) Non Wearing Course Mixture ((3),(4))	metric ton **[ton]**
2360.503 Type SP (1) (2) Course Mixture ((3),(4)) (5) mm **[inch]** thick	square meter **[square yard]**
2360.504 Type SP (1) (2) Course Mixture ((3),(4))	**[square yard inch]**
2360.505 Type SP (1) Bituminous Mixture for Specified Purpose	metric ton **[ton]**
2360.506 Type SP (1) Bituminous Mixture Production	metric ton **[ton]**

(1) Aggregate Size Designation, 9.5, 12.5 or 19 as appropriate.
(2) "Wearing" or "Non Wearing" as appropriate.
(3) Traffic Level as per Table 2360-1-A.
(4) AC binder grade designation.
(5) Specified lift thickness.

SB-15 (2360) BITUMINOUS WEARING COURSE

This work shall consist of placing a bituminous wearing course on both bridge approaches and bridge deck as shown in the Plans. The wearing course shall

be a minimum of 4 inches thick for bridge approaches and extend 100 feet on both ends of the bridge. Bituminous on bridge deck shall be 2 inches thick at the beginning and end of bridge deck and will vary to 5 3/4 inches max at bridge midspan due to the roadway vertical curve and construction tolerances.

The plant mixed bituminous pavement shall be constructed in accordance with the provisions of MnDOT 2360. The Mixture Designation shall be SPWEB240B.

SB-15.1 Payment of Item No. 2360.503 "Type SP 12.5 Wearing Course Mixture (2,B) "4" Thick at the Contract price therefor shall be compensation in full for all costs of performing all of the work described above, and all costs for hauling, mixing, placing, and compacting the wearing course in place on the bridge deck.

SB-16 (2401) CONCRETE BRIDGE CONSTRUCTION

The provisions of MnDOT 2401 are modified and/or supplemented with the following:

Delete the first sentence of the first paragraph of 2401.3G:

Cure newly placed concrete by providing protection against rapid loss of moisture, freezing temperatures, high temperatures, abrupt temperature changes, vibration exceeding a normal or reasonable limit as described in the Bridge Construction Manual chapter .362, shock waves, and prematurely applied loads.

Add the following to the end of the second paragraph of 2401.3G:

All sections not included in superstructures.....45

SB-16.1 Concrete Aggregate for Bridges

Delete the second paragraph of 2401.2A and substitute the following therefor:

Class A coarse aggregate, as defined in 3137.2B, shall be used in all concrete for bridge superstructures, except that coarse aggregate requirements for precast concrete members fabricated under 2405 shall be as specified in 2461.2D.

SB-16.2 Joint Filler and Sealing

Supplement MnDOT 2401.3J1 provisions as follows:

Complete concrete curing prior to installation of sealing materials. A minimum of 7 days drying is required prior to application of sealers. At the time sealer

is installed, sawcut joints must be sandblasted, blown clean, and the concrete surfaces dry.

Construct preformed joint(s) as detailed in the plans and in conformance with the following requirements.

1. Bituminous felt must comply with AASHTO M33, modified to the extent that the load required to compress the test specimen to 50 percent of its thickness before test be not more than 1200 psi (8274 kPa).

2. Cork must comply with MnDOT 3702 and AASHTO M153 Type II.

3. Polystyrene must comply with the following:

Type	Minimum Compressive Strength (5 percent deflection)	Characteristics
A (High Density)	30 psi (207 kPa)	Closed Cell Expanded Polystyrene
B (Low Density)	10 psi (69 kPa)	Molded Polystyrene

Test for compressive strength of polystyrene in accordance with ASTM D 1621. Furnish evidence that the material meets these requirements, if requested by the Engineer.

The quantity of preformed cork joint filler material given in the plans is for convenience only. Furnish any additional joint filler required at no additional compensation.

SB-16.3 Finish of Concrete Surfaces

Cure concrete for a minimum of **28** days or as recommended by the manufacturer prior to applying special surface finish (SSF) or acrylic paint. Thoroughly flush all surfaces that are to receive SSF with clean water not more than 24 hours before commencing with the SSF finishing.

A. Special Surface Finish

The provisions of 2401.3F2c shall apply except as modified herein:

Apply SSF on the exposed concrete surfaces as designated below:

- Barrier Railings or Parapets (other than Type F)
- Outside surfaces of barrier railing

Provide a finish color for all SSF matching MnDOT standard color "Gray-Modified" on file in the MnDOT Chemical Laboratory (651-366-5548), or Federal Std. No. 595 B, No. 26622 (pearl gray). Provide paint free of toxic metals and toxic pigments.

Apply a top coat of 100% acrylic paint (MnDOT Spec. 3584) in the color specified.

Add the following sentence after the fourth sentence in the second paragraph of 2401.3F2c:

Furnish only one approved system of mortar, bonding agent, water, and 100% acrylic paint (meeting MnDOT 3584) from the "Approved/Qualified Product Lists of Special Surface Finish" (http://www.dot.state.mn.us/products/index.html) to produce the color(s) specified in this special provision.

B. Finishing Roadway Faces and Tops of Barrier Railing

1. Finish conventionally formed roadway faces, tops of barrier railings (and medians), as per 2401.3F2d and the following:

a) Plan and execute concrete placement, form removal, and finishing operations so that the surface finishing can be started immediately after forms are removed. Remove the roadway face forms as soon as the concrete can retain its molded shape. In no case shall the elapsed time between concrete placement and initial surface finishing exceed 24 hours.

b) After completion of the curing period, paint the roadway faces and tops of the barrier railings (and median) with an approved acrylic paint conforming to 3584. The color of the acrylic paint shall conform to MnDOT standard color "Gray-Modified" on file in the MnDOT Chemical Laboratory (651-366-5548), or Federal Std. No. 595 B, No. 26622 (pearl gray). Apply the paint at a rate of 7.4 m^2 per L (**300 ft^2 per gallon**). Commence or suspend the painting operation when the air and surface temperature meet or exceed the manufacturer's recommendations.

2. Finish slipformed roadway faces and tops of barrier railings (and median), in accordance with the following:

a) Lightly broom the railing surface immediately after passage of the slipformer.

b) Coat the roadway face and top of the barrier railing as described above for the conventionally formed railing.

C. Finishing Precast Concrete Girders

Apply 100% acrylic paint (MnDOT 3584) on the exposed concrete surfaces as designated below.

- Outside face of fascia girder

Provide a finish color for acrylic paint matching MnDOT standard color "Gray-Modified" on file in the MnDOT Chemical Laboratory (651-366-5548), or Federal Std. No. 595 B, No. 26622 (pearl gray).

Apply the paint at a rate of 7.4 m^2 per L (**300 ft^2 per gallon**). Commence or suspend the painting operation when the air and surface temperature meet or exceed the manufacturer's recommendations.

D. Basis of Payment

Finishing of concrete surfaces, except as otherwise provided in these special provisions, special surface finish, application of topcoat, and painting are considered an incidental expense to the respective concrete rail mix and prestressed beams for this construction and no additional compensation will be made for this work.

SB-17 (2405) PRESTRESSED CONCRETE BEAMS

The provisions of MnDOT 2405 are modified and/or supplemented with the following:

Delete the first paragraph of 2405.3M and substitute the following:

Prestressed concrete beams shall be erected in a manner that will provide safety to the workers, inspectors, and the public, at all times, as well as reasonable assurance against damage to the prestressed members. Prior to the placement of diaphragms, the prestressed beams shall be temporarily anchored, braced, and stabilized as they are erected so as to preclude sliding, tipping, buckling, or other movement that may otherwise occur. If active vehicular or railroad traffic will be permitted to travel beneath beams prior to complete erection of all the beams and diaphragms in a span, the Contractor shall submit an erection plan prepared by an engineer, thoroughly checked by a second engineer for completeness and accuracy, and certified by one of the aforementioned professional engineers licensed in the State of Minnesota which details all temporary works necessary to brace and stabilize beams. Struts, bracing, tie cables, and other devices used for temporary restraint shall be of a

size and strength that will ensure their adequacy. The Contractor shall arrange the work schedule so that at least two adjacent I-beams will be erected (including diaphragms and bolts fully tightened) and braced in any one span before operations are suspended for the day.

This work shall be performed in accordance with the provisions of MnDOT 2405 except as modified below:

SB-17.1 Prestressed Concrete Fabricator Certification

The Fabricator's quality control office shall maintain documentation containing the data required by the specifications and the State Materials Engineer. This documentation shall contain test data and measurements taken at times and locations approved by the Engineer, assuring that monitoring, by personnel not directly involved in production, is sufficient to ensure compliance with approved procedures.

If the Engineer's review of fabrication work discloses that approved procedures are not being followed, the Fabricator shall immediately correct the procedure.

The Engineer will determine what additional testing work must be done by the Fabricator or, if necessary, what part of the work must be repaired or replaced if the fabrication work is not properly monitored and documented by the Fabricator.

Any and all costs of required additional monitoring and testing shall be at the expense of the Contractor with no additional compensation.

SB-17.2 Prestress Transfer

The Fabricator of prestressed concrete beams shall closely monitor the ends of the beams during the strand release process. The following sequence of releasing the individual prestressing strands will be required if cracks occur in the ends of the beams during the fabricator's releasing sequence.

Delete the first sentence of the second paragraph of 2405.3H.

Add the following to 2405.3H:

Prestress transfer shall be conducted in a sequential and alternating manner symmetrical to the vertical axis of the beam in order to minimize the lateral eccentricity of the prestress forces and diminish cracking of the concrete. The sequence of individual prestressing strand release shall be in accordance with the following criteria unless different criteria are approved by the Engineer.

1) Beginning with the *straight* strands closest to the vertical axis of the beam and in the second row from the bottom of the beam, release the strands each

side of center. Then, progress outward in the same row at every other strand alternating each side of the vertical axis. Repeat the sequence for the third and subsequent rows from the bottom upward until approximately one-fourth of the straight strands have been released.

2) Release one-half of the *draped* strands alternating about the vertical axis.

3) Release the hold-down anchors for the draped strands.

4) Release the remainder of the *draped* strands alternating about the vertical axis.

5) Release the remainder of the *straight* strands beginning with the strand in the bottom row nearest the vertical axis. Release all the strands in that column moving upward. Proceed two columns away from this column and release the strands bottom to top. Next move to the outer most column and release strands bottom to top. The remainder of the strands shall be released bottom to top starting with the inner most column.

Once release has started, all strands of that beam shall be released in the sequence described above even if cracking is noticed near the end of the beam. The Engineer shall be notified immediately of any cracking and no other beams with the same strand pattern may be fabricated until the Engineer has approved a revised release sequence.

SB-17.3 MnDOT required Shop Inspections

Fabrication of the prestressed box beams shall be done at a PCI-certified facility. If fabrication is to take place at a manufacturing facility not normally receiving Minnesota DOT inspection, the QA/QC program for the facility shall be submitted for approval at least sixty days before the planned start of production. For the required pre-approval and other details regarding MnDOT shop inspection, contact Steve Grover in the MnDOT Materials Lab at 651-366-5540.

All costs of providing inspection at the manufacturing facility, including time, meals, mileage, daily living expenses, etc., will be deducted from payments for "Prestressed Concrete Beams, Type 1." This will include expenses incurred for providing inspection at manufacturing facilities normally receiving Minnesota DOT inspection, as listed above, or at facilities that do not normally receive Minnesota DOT inspection.

All costs incurred by the manufacturer for meeting the requirements for MnDOT shop inspections of the prestressed box beam manufacturing facility shall be considered included in the bid price for Item "Prestressed Concrete Box Beams 33x48."

SB-17.4 Box Beam Void Forms

Fabrication of the prestressed box beams void forms shall be constructed using preformed expanded polyethylene or another material as accepted by the Engineer. Box beam void forms shall be constructed to be watertight and resistant to breakage and deformation during concrete placement.

All internal forms must be accurately located and held in place during concrete placement. Each individual beam shall be poured monolithically. In monolithic pours, inner forms will have a tendency to float. The force required to hold the inner form in place can be calculated assuming the concrete to be completely liquefied. The Fabricator shall design a hold-down system that will prevent localized compression failure of the top of expanded polyethylene blocks and resist any uplift floatation forces.

SB-17.5 Debonding of Strands

Debond strands as shown in the Plans. Use acceptable plastic wraps, sleeves or taping as approved by the Engineer.

SB-17.6 Sealing of Beam Ends

Beam ends will be exposed to earth backfill and shall be sealed to prevent early deterioration during their expected service life. Strand ends shall be nominally recessed and patched. Three systems will be used to accomplish this task: epoxy mortar, epoxy paint, and bitumen coating.

Fabricator shall provide a nominal recess at each beam end to protect all strand ends. The recess-forming device shall be fabricated with a proprietary expanded foam cube, sometimes called a doughnut, placed on each strand directly against the inside of the bulkhead. This doughnut should be approximately 1 ½ inches square and ¾ inch thick with a hole through the center to accommodate the strand. The doughnut shall have a slit on one edge to allow the doughnut to be placed on the strand prior to placing the concrete.

During the finishing process the expanded foam doughnuts shall be removed and projecting strands burned/cut out flush with the back of the recess using an oxyacetylene touch or hand-held high speed disc grinder. Great care shall be taken to ensure the concrete is not damage while trimming the strands flush regardless of the two methods the fabricator elects to perform.

The recesses shall than be cleaned-out to remove all debris consisting of but not limited to expanded foam, strand slag, grindings, and blackened torch soot. A final cleaning of all recesses/beam ends shall then be performed to meet all of the manufacture's requirements for the epoxy mortar and epoxy paint that will be applied. After final cleaning is completed the recesses/beam ends shall be approved by the Engineer for cleanliness.

Once cleaned and Approved by the Engineer the recesses shall be filled with epoxy mortar as recommended per the manufacturer. After the epoxy mortar cures epoxy paint shall be applied per manufacture's recommendations to all beam ends and end sides that will be in contact with earth by the Fabricator. The Fabricator shall then apply a bitumen coating to the all areas at beam ends that epoxy paint was applied.

The use of portland cement mortar and proprietary patching compounds shall not be supplemented for the epoxy mortar at beam ends.

After the beam joints are grouted per these Special Provisions at the job site the Contractor shall apply a 12 inch wide member watering proofing system to all beam joints along the entire beam top and each beam end per MnDOT Spec 3757.

All epoxy mortar, epoxy paint, and bitumen coating used shall be listed on MnDOT Approved Products List or as approved by the Engineer.

SB-17.7 Basis of Payment

All work performed including all materials, work, and incidentals as described above shall be considered an incidental expense to the price bid for "Prestressed Concrete Box Beams 33x48."

SB-18 GROUT BETWEEN POST-TENSIONED BEAMS

A. Loading

No post-tensioning of any span will be permitted until the following events have occurred:

1) All of the longitudinal joints between beams have been filled with grout.

2) At least 48 hours have elapsed from the time the last joint was filled.

There shall be no force in the transverse tie rods or strands until the grout between the beams has been allowed to cure for at least 48 hours.

B. Preparation for Grout Placement

All joint surfaces shall be thoroughly cleaned using a high pressure wash. The ends and bottoms of the joint shall be tightly sealed prior to placing grout material to prevent grout loss during placement. The work shall be done in such a manner that the sealing material shall be within 75mm (**3"**) of the bottoms and ends of the beams. Joints that have not been coated with a penetrating sealer shall be continuously prewetted over all surfaces for a minimum of 24 hours.

Prior to grouting and tensioning of the transverse ties, seal washers, as detailed in the plans, shall be installed at each joint at each post-tensioned duct to prevent grout from entering the ducts.

C. Mixing – General

The following mixing requirements shall be adhered to:

1) Mixing shall be done as close as possible to the joint to be filled.

2) All necessary equipment for mixing and placing shall be present at the work site prior to the start of mixing. All equipment shall be in good working order as approved by the Engineer.

3) Material which, in the Engineer's opinion is not pourable, exhibits signs of setting or hardening, prior to placement, shall not be incorporated in the work. It shall be removed from the work site.

D. Placement of Cement Based Grout Material for Joints Between Beams

1) Use one of the following mixes, proportioned by weight for the grout between the post-tensioned beams:

Mix 1:

Component	Quantity (pounds per cubic yard)
Type I Portland Cement	468
Type N Masonry Cement (ASTM C270)	349
Fine Aggregate	1991
Net Water (approx.)	415

Mix 2:

Component	Quantity (pounds per cubic yard)
Type I Portland Cement	930
Fine Aggregate	1966
Net Water (approx.)	415

Provide an entrained air content in the mix of 14% +/- 4% by using Portland air-entraining cement, masonry cement, or a department-approved air entraining admixture.

Add water if necessary, to obtain a consistency that ensures that the space between beams is completely filled.

2) Grout shall not be placed during rainfalls.

3) Grout shall not be placed if the ambient temperature is outside the range of 7° C to 32° C (**45° F** to **90° F**), or if the ambient temperature is expected, or predicted, to become lower than 7° C (**45° F**) for a period of 12 to 15 hours after placement. The temperature of the surface against which the grout is to be placed shall be at least 7° C (**45° F**). After the grout has been placed, it shall be dusted with the same brand and type of cement used in the production of the concrete units. The color shall match the surrounding concrete surface.

4) No placement interruptions will be permitted. Grout shall be thoroughly rodded as it is placed in the joint to ensure that all voids are filled. Care shall be taken to ensure that no grout enters the post-tensioning ducts prior to tensioning of the transverse ties. Grout shall be finished flush with the top of joint. When a camber differential exists between beams at the joint, the grout shall be filled to the highest beam and trowel finished at a 1 to 4 slope to the lower beam.

5) Grout shall be wet cured for a minimum of 48 hours and coated with an approved curing compound as directed by the Engineer.

E. Tensioning of Transverse Ties

Tensioning shall be completed prior to performing any further work on the superstructure (see next section). Transverse ties shall be tensioned to the force shown on the plans. Tensioning shall not be done until the requirements of Section "D" – Placement of Cement Based Grout Material for Joints Between Beams have been accomplished.

F. Basis of Payment

Grouting of joints between the beams including all materials, work, and incidentals as described above shall be considered an incidental expense to the price bid for "Prestressed Concrete Box Beams 33x48."

SB-19 POST-TENSIONING

This work shall consist of furnishing, installing, stressing and grouting post-tensioned prestressing steel in accordance with the details shown on the working drawings approved by the Engineer, the requirements of these specifications, and the applicable provisions of MnDOT 2401 and 2405.

It shall also include the furnishing and installing of any appurtenant items necessary for the particular post-tensioning system and pressure grouting of ducts.

A. General

Working drawings of the proposed post-tensioned concrete members shall be submitted in accordance with the requirements of 1502 and these special provisions.

The Contractor shall prepare composite drawings in plan, elevation and section which show to scale the relative positions of all items that are to be embedded in the concrete, the concrete cover, and the embedment depth. Such embedded items include prestressing ducts, vents, anchorage reinforcement and hardware, and reinforcing steel strand. Such drawings shall be adequate to ensure that there will be no conflict between the planned positions of any embedded items, and that concrete cover will be adequate. If, during the preparation of such drawings, conflicts are discovered, the Contractor shall revise the working drawings for one or more of the embedded items, or proposed changes in the dimensions of the work as necessary to eliminate the conflicts or provide proper cover. Any such revisions shall be approved by the Engineer before work on an affected item is started.

The drawings shall show the method and procedure of jacking and the type, size, and properties of the strands or bars and the anchorage assemblies. The number of strands per tendon shall be shown. Details in addition to those shown on the contract plans shall be included for any additional reinforcing steel required to resist the concrete bursting stresses in the vicinity of the anchorage assemblies. The force or stress diagram shall be shown on the drawings. The sizes, shapes, and dimensions shall be shown for the ducts. Vent locations and details of the vents shall also be included on the drawings.

The drawings shall include complete details of the method, materials, and equipment proposed for use in the prestressing operations. Such details shall outline the method and sequence of jacking, show complete details of the prestressing steel, anchoring devices, type of enclosures, block-outs, and show all other data pertaining to the post-tensioning system or operations.

Calculations shall be submitted showing, at each stage of erection, the elongation of the strands at the time of jacking, the initial forces in the strands, prestress losses, parameters, and the final working forces. Calculations shall show the stresses in the anchorages and distribution plates.

Final prestress losses and final working forces are not required when the post-tensioning system is fully designed and detailed in the Plans and the Contractor does not propose to change the system.

Complete details for the grouting shall conform to the following Special Provision section, or details shall be submitted for grouting prestressing tendons

including the materials and proportions for grout, details of equipment for mixing and placing grout and methods of mixing and placing grout.

The Contractor will not be required to duplicate in the working drawings any aspect of the system that is fully detailed in the plans or special provisions unless a change is proposed.

B. Post-Tensioning System Requirements

1) The prestressing steel shall be one of the following:

a) Grade 270 low relaxtion 7-wire strand meeting the requirements of AASHTO M203, ASTM A 416.

b) Grade 150, high strength, threaded bar meeting the requirements of ASTM A 722, Type II.

2) The net force in the transverse tensioning ties after all losses shall meet the minimum required by the plans.

3) Concrete allowable stresses shall not be exceeded.

4) All provisions of the design criteria, as noted on the plans, shall be satisfied.

C. Protection of Prestressing Steel

All prestressing steel shall be protected against physical damage at all times from manufacture to grouting or encasing in concrete. Prestressing steel that has sustained physical damage at any time shall be rejected. Any reel of prestressing steel that is found to contain broken wires shall be rejected and the reel replaced.

1) Packaging

Prestressing steel shall be packaged in containers or shipping forms for protection of the steel against physical damage and corrosion during shipping and storage. A corrosion inhibitor, which prevents rust or other results of corrosion, shall be placed in the package or form, or shall be incorporated in a corrosion inhibitor carrier type packaging material, or when permitted by the Engineer, a corrosion inhibitor may be applied directly to the steel. The corrosion inhibitor shall have no deleterious effect on the steel or concrete or bond strength of steel to concrete. Inhibitor carrier type packaging material shall conform to the provisions of Federal Specification MIL-P-3420. Packaging or forms damaged from any cause shall be immediately replaced or restored to original condition.

The shipping package or form shall be clearly marked with the heat number and with a statement that the package contains high strength prestressing steel, and care is to be used in handling. The type and amount of corrosion inhibitor used, the date when placed, safety orders and instructions for use shall also be marked on the package or form.

2) Storage

The prestressing steel shall be stored in a manner which at all times prevents the packaging material from becoming saturated with water and allows a free flow of air around the packages. If the useful life of the corrosion inhibitor in the package expires, it shall immediately be rejuvenated or replaced.

3) Installation

At the time the prestressing steel is installed in the work, it shall be free from loose rust, loose mill scale, dirt, paint, oil, grease or other deleterious material. Removal of tightly adhering rust or mill scale will not be required. Prestressing steel which has experienced rusting to the extent that it exhibits pits visible to the naked eye shall not be used in the work.

4) Protection After Installation

If the period of time between installation of prestressing steel and grouting of the duct will exceed 10 calendar days, the prestressing steel shall be protected from corrosion during the entire period it is in place but ungrouted as provided below.

When corrosion protection of in-place prestressing steel is required, a corrosion inhibitor which prevents rust or other results of corrosion shall be applied directly to the prestressing steel. The corrosion inhibitor shall have no deleterious effect on the prestressing steel or grout or bonding of the prestressing steel to the grout. The inhibitor shall be water soluble. The corrosion inhibitor, the amount and time of initial application, and the frequency of reapplication shall be approved by the Engineer.

D. Post-Tensioning Operations

1) Tensioning

All post-tensioning steel shall be tensioned by means of hydraulic jacks so that the force of the prestressing steel shall not be less than the value shown on the approved installation drawings. The maximum

temporary tensile stress (jacking stress) in prestressing steel shall not exceed 80 percent of the specified minimum ultimate tensile strength of the prestressing steel. The prestressing steel shall be anchored at initial stresses in a way that will result in the ultimate retention of permanent forces, not less than those shown on the approved installation drawings, but in no case shall the initial stress at the anchors, after anchor set, exceed 70 percent of the specified minimum ultimate tensile strength of the prestressing steel. Permanent force and permanent stress will be considered as the force and stress remaining in the prestressing steel after all losses, including creep and shrinkage of concrete, elastic shortening of concrete, relaxation of steel, losses in posttensioned prestressing steel due to sequence of stressing, friction and take-up of anchorages, and all other losses peculiar to the method or system of prestressing have taken place or have been provided for.

2) Friction

When friction must be reduced, water soluble oil or graphite with no corrosive agents may be used as a lubricant subject to the approval of the Engineer. Lubricants shall be flushed from the duct as soon as possible after stressing is completed by use of water pressure. These ducts shall be flushed again just prior to the grouting operations. Each time the ducts are flushed, they shall be immediately blown dry with oil-free air. The Contractor shall submit a plan for capturing all fluids generated by the flushing method for approval by the Engineer. No lubricants or flushing water will be allowed to enter any waterways or environmentally sensitive areas.

3) Stressing Jacks

Each jack used to stress tendons shall be equipped with a pressure gauge having an accurately reading dial at least 150 mm in diameter for determining the jack pressure or jack force.

4) Calibration

Prior to use for stressing on the project, each jack and its gauge shall be calibrated as a unit by a testing laboratory approved by the Engineer. Calibration shall be done with the cylinder extension approximately in the position that it will be when applying the final jacking force and with the jacking assembly in an identical configuration to that which will be used at the job site (i.e., same length hydraulic lines). Certified calibration calculations and a calibration chart shall be furnished to the Engineer/Inspector for each jack.

5) Recalibration

Recalibration of each jack shall be done at six-month intervals and at other times when requested by the Engineer/Inspector. At the option of the Contractor, calibrations subsequent to the initial laboratory calibration may be accomplished by the use of a master gauge. The master gauge shall be supplied by the Contractor in a protective waterproof container capable of protecting the calibration of the master gauge during shipment to a laboratory. The Contractor shall provide a quick-attach coupler next to the permanent gauge in the hydraulic lines which enables the quick and easy installation of the master gauge to verify the permanent gauge readings. If any repair to, or modification of, a jack is accomplished, such as replacing the seals or changing the length of the hydraulic lines, the jack shall be recalibrated by the approved testing laboratory. No extra compensation will be allowed for the initial or subsequent jack calibrations or for the use and required calibration of a master gauge.

6) Stressing of Tendons

a) The tensioning process shall be conducted so that the tension being applied and the elongation of the prestressing steel may be measured at all times. A permanent record shall be kept of gauge pressures and elongations at all times and shall be submitted to the Engineer. The post-tensioning force may be verified as deemed necessary by the Engineer. The tendon force measured by gauge pressure shall agree within five percent of the theoretical elongation or the entire operation shall be checked and the source of error determined and remedied to the satisfaction of the Engineer before proceeding with the work. Elongations shall be measured to the nearest millimeter. Equipment for tensioning the tendons must be furnished by the manufacturer of the system. Should agreement between gauge readings and measured elongations fall outside the acceptable tolerance, the Engineer may require, without additional compensation to the Contractor, additional in-place friction tests in accordance with this specification.

b) In the event that more than two percent of the individual strand wires in a tendon break during the tensioning operation, the strand (or strands) shall be removed and replaced. Previously tensioned strands shall not be allowed unless approved by the Engineer.

c) Post-tensioning bars used to apply temporary post-tensioning may be reused if they are undamaged.

d) Prestressing steel shall be cut using an abrasive saw between 20 to 40 mm (**0.75 to 1.5 inch**) from the anchoring device, or as shown on the installation drawing.

E. Basis of Payment

All costs associated with the materials, labor, and incidentals necessary for post-tensioning as described above shall be included in the price bid for "Prestressed Concrete Beams, Type 1" including but not limited to tensioning ties, anchorage assemblies, additional reinforcement for supporting ducts, lubricants, cleaning of ducts, grout and grouting, testing, anchorage protection systems, labor, materials, tools, equipment and incidentals necessary for completing the work in accordance with Contract requirements.

SB-14 GROUTING OF DUCTS

After post-tensioning and anchoring has been completed and accepted, the duct shall be grouted in accordance with this specification, or alternate as submitted. In the interval between the post-tensioning and grouting operations, the prestressing steel shall be protected. Immediately after post-tensioning, all grout vents of each duct shall be temporarily sealed with plugs to prevent entrance of air or water. The plugs shall be left in place until just prior to duct grouting.

A. Materials

Use a grout composition of 94 pounds of Type I cement, 5 gallons of water and 1 pound of approved plasticizer or a pre-mixed packaged grout that is approved by the engineer, in the post-tensioned ducts.

B. Batching Equipment

Equipment for batching component materials shall be capable of accurately measuring and dispensing the materials.

C. Mixer

The mixer shall be capable of continuous mechanical mixing of the ingredients to produce a grout which is free of lumps and in which the ingredients are thoroughly dispersed.

D. Screen

The grouting equipment shall contain a screen having clear openings of 3 mm (**1/8 inch**) maximum size to screen the grout prior to its introduction into the grout pump. If a grout with a thixotropic additive is used, a screen opening of 5

mm (**3/16 inch**) is satisfactory. This screen shall be easily accessible for inspection and cleaning.

E. Grout Pump

Grout pumps shall be capable of pumping the grout in a manner which complies with the provisions of this specification. Pumps shall be a positive displacement type capable of producing an outlet pressure of not less than 1 MPa (**145psi**) and shall have seals which are adequate to prevent introduction of oil, air or other foreign substance into the grout and to prevent loss of grout or water. Backup pumps shall be available.

F. Pressure Gauge

A pressure gauge having a full scale reading of no greater than 2 MPa (**290psi**) shall be placed at some point in the grout line between the pumping outlet and the duct inlet. The grouting equipment shall utilize gravity feed to the pump inlet from a hopper attached to and directly above it. The hopper must be kept at least partially full of grout at all times during the pumping operation to prevent air from being drawn into the post-tensioning duct.

G. Pipes and Other Fittings

Pipes or other suitable devices shall be provided for injection of grout and to serve as vent holes during grouting. The material for these pipes shall be at least 13 mm (**1/2 inch**) inside diameter and may be either metal or a suitable plastic which will not react with the concrete or enhance corrosion of the prestressing steel and is free of water soluble chlorides. These pipes shall be fitted with positive mechanical shut off valves capable of withstanding grouting pressures. All connections between a grout pipe and a duct shall be made with metal or plastic structural fasteners and taped with a waterproof tape as necessary to assure a water tight connection.

H. Mixing Grout

The sequence for charging the mixer shall be to add water, start the mixer and then add cement. When cement and water are reasonably well mixed, admixtures shall be introduced in accordance with written instructions of the manufacturer of each admixture. The mixing procedures shall avoid having the admixture catch on the blades or the sides of the mixing drum and from forming gel globules. The mixing procedure may be varied in accordance with the written recommendations of the manufacturer of the admixtures. The grout shall be mixed until a uniformly blended mixture is obtained and shall be continuously agitated until it is introduced into the grout pump. Batches of grout shall be placed within 30 minutes of completion of mixing. No water shall be added to the grout to modify its consistency after the initial mixing operation is completed.

I. Cleaning and Flushing Tendons

If a water soluble lubricating oil or corrosion inhibiting oil is applied to the prestressing steel or an embedded tendon is discontinuous through a joint between segments, the tendon shall be flushed as provided below.

Immediately prior to grouting operations, the inside of the tendon shall be flushed with water meeting the requirements of this specification (under pressure) to remove all traces of the corrosion inhibitors used to protect the prestressing steel. Flushing operations shall continue until the discharge water is free of any traces of the corrosion inhibitor. All water containing corrosion inhibitor chemicals shall be collected in containers and disposed of as required by governmental regulations. Following the cleaning operations, water shall be totally drained from within the tendon and it shall be blown out with compressed oil-free air to the extent necessary to dry the prestressing steel and the inside surfaces of the pipe.

J. Placing Grout

Grouting shall start at the lowest injection point with all vent holes open. The pumping pressure through the pipe shall be maintained until grout is continuously wasted at the next vent hole and no visible slugs or other evidence of water or air are ejected and the grout being ejected has the same consistency as the grout being injected. The vent valve shall then be closed, the pumping pressure held momentarily and the valve at the injection port closed.

1) Pressure

The pumping pressure at the tendon inlet shall not exceed 1.75 MPa (**250psi**), however, normal operations shall be performed at 0.50 MPa (**72.5psi**). If the actual grouting pressure exceeds the maximum recommended pumping pressure, grout may be injected at any vent hole which has been or is ready to be closed as long as a one-way flow of grout is maintained. When one-way flow of grout cannot be maintained, the grout shall be immediately flushed out of the duct with water. The shut-off valves on the pipes serving as injection ports or vent ports shall not be opened until the grout has taken its final set.

2) Temperature

When it is anticipated that the air temperature will fall below 0° C (**32° F**), ducts shall be kept free of water so as to avoid freeze damage to ducts. No grouting shall be done when the temperature of the grout is below 7° C (**45° F**). The temperature of the concrete or air surrounding the tendon shall be maintained at 2° C (**35° F**) or above from the time grout is

placed until the compressive strength of the grout, as determined from tests on 50 mm (**2 inch**) cubes cured under the same conditions as the in-place grout, exceeds 5.5 MPa (**800psi**).

Under hot weather conditions, grouting shall take place early in the morning when daily temperatures are lowest. No grouting shall be done when the temperature of the grout exceeds 32° C (**90° F**). It may be necessary to chill mixing water or take other special measures to lower the temperature of the grout. After the grout has set, pipes used as injection or vent ports shall be cut off. Metal pipes shall be cut off 25 mm (**1 inch**) below the surface of the concrete. Plastic pipes shall be cut off flush with the surface of the concrete.

K. Protection of Prestress Anchorages

As soon as possible after tensioning and grouting is completed, but not exceeding 14 days, exposed end anchorages, strands, and other metal accessories shall be cleaned of rust, misplaced mortar, grout, and other such materials. Immediately following the cleaning operation, the entire surface of the anchorage recess (all metal and concrete) shall be thoroughly dried and uniformly coated with an epoxy bonding compound conforming to AASHTO Specification M235, Class III in accordance with the manufacturer's recommendations.

Immediately following application of the epoxy bonding compound, tight fitting forms shall be installed and the anchorage recess shall be filled with a non-shrink cement based grout. Proportion by weight the cement, fine aggregate, and non-shrink admixture for the grout in the stress pockets, as indicated in the following table. Use Type I cement. Add water as necessary to obtain a 75 mm (**3 inch**) maximum slump. Furnish a metallic aggregate non-shrink admixture such as Embeco, Ferrolith-G, Groutex, Iso-Vol., Vibrofoil, or equal.

Cement	**Fine Aggregate**	**Non-Shrink Admixture**
188 lbs	300 lbs	100 lbs

The following non-chloride, pre-mixed commercial non-shrink grouts, placed according to the manufacturer's instructions, may be used in the stress pockets in lieu of the cement grout above. Limit slump to a 75 mm (**3 inch**) maximum.

Product	**Source**
SET Non-Shrink Grout, Cleveland, OH	Master Builders
Sonogrout, Sonneborn Building Prod. Div., Minneapolis, MN	Sonneborn-Contech
Five Star 400 Grout, Old Greenwich, CT	U.S. Grout Corporation
Sure-Grip Grout, Oregon, IL	Dayton-Superior

L. Basis of Payment

Grouting of ducts is considered an incidental expense as specified in the previous section of these Special Provisions.

SB-20 (2411) CONCRETE MASONARY WALL

SB-20.1 General Requirements

Concrete Masonry Units (CMU's) used on this job shall have the nominal dimensions of 7 5/8" H x 15 5/8" L x 7 5/8" W. Block dimensions may very no more than ±1/8 inch from the standard values published by the manufacturer and shall be in accordance with ASTM specifications.

All solid core, hollow core, concrete filled and corner CMU's shall meet all of the below specifications.

A single block type and style shall be used throughout each wall. The color and surface texture of the block type and style shall be chosen from the manufacture's standard colors, by the County. Corners should be constructed per block manufacture's recommendations as approved by the Engineer.

SB-20.2 Testing Requirements

A. All CMU's shall be manufactured per the following:
1. Meet or exceed ASTM C90.

2. CMU's shall be sampled and tested according to ASTM C140.

3. Minimum Compressive Strength shall be 4000 psi (Average of three units)

4. Water Absorption Limit is 5% (Average of three units)

5. Cementitious materials and aggregates shall all applicable ASTM standards.

B. CMU's shall have been cured for not less than 28 days when placed in the structure.

C. Units that are cracked, chipped, or have other imperfections in accordance to ASTM C1372 or excessive efflorescence shall not be used within the wall.

D. The requirements of Technical Memorandum for Use of Dry-Cast Segmental Masonry Retaining Walls Units in regards the ASTM C1262 and ASTM C1372 shall NOT be required on this project, but CMU's meeting these requirements will be accepted.

All blocks shall be certified as to strength, absorption, and sealing requirements unless, due to contract changes after letting, certified blocks are not available when required. At the time of delivery of certified blocks, furnish the engineer a certified test report from a department-approved independent testing laboratory for each lot of modular blocks. The certified test report shall clearly identify the firm conducting the sampling and testing, the type of block, the date sampled, name of the person who conducted the sampling, the represented lot, the number of blocks in the lot, and the specific test results for each of the stated requirements of this specification. A lot shall not exceed 5,000 blocks. The certified test results will represent all blocks within the lot. Each pallet of blocks delivered shall bear lot identification information. Block lots that do not meet the requirements of this specification or blocks without supporting certified test reports, or as allowed above, will be rejected and shall be removed from the project at no expense to the department.

E. A department-approved independent testing laboratory may control and conduct all CMU sampling and testing for certification. Prior to sampling, the manufacturer's representative shall identify all pallets of modular blocks contained in each lot. All pallets of blocks within the lot shall be numbered and marked to facilitate random sample selection.

The purchaser or his authorized representative shall be accorded proper access to the manufacturer to inspect and sample the concrete blocks at the place of manufacture from lots ready for delivery.

SB-20.3 Sealing

A. All block used on this project should have an integral concrete sealer/water repellent applied during the manufacturing process.

In addition to the integrally applied sealer the Contractor shall apply a concrete sealer/water repellent to all CMU's in the field after the concrete masonry wall is constructed. This product shall be compatible with the integral concrete sealer/water repellent during manufacturing as recommended by the CMU fabricator and should be applied at the heaviest application rate as specified by the manufacturer.

B. All CMU's shall have their surfaces sealed.
CMU wall surface sealing shall consist of preparation, furnishing and applying the surface sealer to the top, exposed front, and backside of the upper three courses of the all walls.

Surface sealers shall be determined by the block Fabricator and approved by the MnDOT Concrete Engineering Unit (651-366-5575).

C. Due to the potentially hazardous ingredients contained in the sealer formulations extreme care must be exercised in their handling and use, and the manufacturer's recommendations shall be closely followed.

D. Construction Requirements

1. The Contractor shall comply with the manufacturer's written instructions for preparing, handling and applying the surface sealer.

2. The surface to be treated shall receive a light water-blast to the extent that the surface is clean and free of oils.

3. Before the surface sealer is applied the surface to be sealed shall be dry and free of all dust, debris, and frost.

SB-20.4 Concrete for filling CMU's

The top three courses blocks will have the cavities filled with concrete and reinforcement steel. The vertical dimension of the cap shall not be less than 4 inches. All concrete used for filling CMU's shall be MnDOT mix 3Y47A or approved equal as approved be the MnDOT Concrete Unit (651-366-5575).

The use of admixtures will not be permitted in the concrete unless substantiating data is submitted to and approved by the Engineer.

Contractor shall meet all cold requirements. Do not use materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace units damaged by frost or by freezing conditions.

SB-20.5 Visual Inspection

A. All units shall be sound and free of defects that would interfere with the proper placing of the unit or impair the strength or permanence of the construction. Surface cracks incidental to the usual methods of manufacture, or surface chipping resulting from customary methods of handling in shipment and delivery, shall not be deemed grounds for rejection.

B. Cracks exceeding 0.25 inches in width and/or 1.0 inch in depth shall be deemed grounds for rejection.

C. Chipping resulting in a weight loss exceeding 10% of the average weight of the blocks shall be deemed grounds for rejection.

D. Blocks rejected prior to delivery from the point of manufacture shall be replaced at the manufacturer's expense. Blocks rejected at the job site shall not be used.

SB-20.6 Placement of CMU's

CMU's shall be constructed within the specified lines and grades shown on the plans.

The CMU's shall be placed on the geosynthetic reinforcement in such a manner as to produce a smooth plane surface in intimate contact with the reinforcement.

SB-20.7 Submittal

The Contractor shall provide shop drawing showing block layout, corner details, cap details, joint details, field cutting details, block type and color for the approval by the Engineer.

SB-20.8 Consultation

The manufacturer of the articulating CMU's shall provide design and construction advice during the design and installation phases of the project.

SB-20.9 Basis of Payment

All labor, materials, equipment, and incidentals required and all operations in connection with the installation of concrete masonry units in accordance with the lines, grades, design and dimensions shown on the Plans and as specified above shall be considered to be included in payment for Item No. 2411.604 "Concrete Masonry Wall" at the contract price per square feet.

SB-21 (2451) STRUCTURE EXCAVATIONS AND BACKFILLS

The provisions of MnDOT 2451 are modified and/or supplemented with the following:

SB-21.1 Structure Excavation

The item Structure Excavation shall include all excavation, sheeting, and shoring and/or other protection, preparation of foundation, and placing of backfill necessary for construction of the bridge that is not specifically included in other items of the Contract. It shall also include the disposal of surplus material.

Small portions of the existing abutments/wingwalls may be present at the project site. The Contractor shall remove any component of the existing bridge that stills remains at the project from the site. All materials removed shall be properly disposed to the satisfaction of the Engineer.

No measurement will be made of the excavated or backfill material. All work performed as specified above will be considered to be included in a single lump sum for which payment is made under Item No. 2401.601 "Structure Excavation."

For purposes of partial payments, the portion of the lump sum Structure Excavation at each substructure unit will be defined as follows:

Bridge 67564 ..... Each Abutment 50%

SB-22 SLOPE PREPARATION

The Contractor shall excavate and/or construct embankment as necessary, and dress the slopes between the new abutments to the slope lines and limits noted in the Plans, in accordance with the applicable provisions of MnDOT 2105.

Surplus excavated material shall be disposed of on the approach roadway inslopes as directed by the Engineer. Disposal shall include shaping and leveling the material.

The Contractor shall blend new berm slopes to the natural channel slopes at the outer limits of this work.

Payment for Item No. 2401.601 "Slope Preparation" at the Contract price per lump sum shall be compensation in full for performing all of the work described above. Excavation for placement of riprap and filter material is not included in this item and will be paid for under the provisions of 2511.

SB-23 (2461) STRUCTURAL CONCRETE

(2012 Version) ◄DO NOT REMOVE THIS. IT NEEDS TO STAY IN FOR THE CONTRACTORS.

The provisions of MnDOT 2461 are modified in accordance with the following:

SB-23.1 MnDOT 2461.3B shall be deleted and replaced with the following:

B Classification of Concrete

The Department will classify concrete by type, grade, consistency, and aggregate size. Refer to the mix number and Table 2461-2 to determine the mix requirements for each item of work.

Table 2461-2
Mix Number Identification

First Digit	Second Digit	Third Digit	Fourth Digit	Additional Digits
Type	Grade	Slump range	Coarse aggregate gradation range	Class A coarse aggregate when required, modified mix designation, or both

Refer to individual Contract items in the Standard Specification for Mix Numbers. Deviations from the specified Mix Numbers require coordination with the Concrete Engineer.

If the Contract does not show a concrete mix number, provide Type 3, Grade Y concrete with a slump and aggregate gradation determined by the Engineer.

The Department will designate grout by type and grade followed by the word "GROUT." Do not provide grout containing coarse aggregate. If the Plans do not show a type or grade for grout, provide 3A GROUT.

B1 Type Designation

Provide Type 1 or Type 3 concrete in accordance with Table 2461-3:

Table 2461-3
Concrete Type Designation

Concrete Type	Target Air Content*, %	Maximum Water/Cement Ratio‖
1	2.0	≤0.53 for 1A43 ≤0.68 for 1C62 ≤0.64 for 1C Grout
3	6.5 †	≤0.45†#

* For concrete mix design purposes only
‖ The water/cement ratio is defined as the ratio of the total water weight to the total cementitious weight.
† Unless otherwise required by 2301 or elsewhere in the Contract.
#The maximum water/cement ratio for machine placed concrete is 0.42.

B2 Grade Designation

The Department will designate concrete grade using a letter to represent the anticipated compressive strength and the minimum cementitious content in accordance with 2461.3C, "Cementitious Content," and Table 2461-4:

Table 2461-4 Concrete Grade Designation		
Concrete Grade	**Type 1 Anticipated Compressive Strength, *psi [MPa]* ***	**Type 3 Anticipated Compressive Strength, *psi [MPa]* ***
U	6,300 [43]	5,600 [39]
V	6,000 [41]	5,300 [37]
W	5,700 [39]	5,000 [34]
X	5,400 [37]	4,700 [32]
Y	5,000 [34]	4,300 [30]
A	4,500 [31]	3,900 [27]
B	4,100 [28]	3,400 [23]
C	3,200 [22]	2,700 [19]
* Anticipated minimum strength produced in accordance with the Department specifications and cured for 28 days under laboratory conditions.		

The Concrete Engineer, in coordination with the Engineer, may increase the cement content for concrete with test cylinder results less than the anticipated compressive strength in accordance with Table 2461-4, "Concrete Grade Designation." The Contractor may request an increase in the cement content as approved by the Engineer, in conjunction with the Concrete Engineer.

B3 Slump Designation

Refer to the slump designation for the upper limit of the slump range without a water reducer in accordance with Table 2461-5:

Table 2461-5 Slump Designation	
Slump Designation	**Slump Range without Water Reducer, *in [mm]***
1	½ – 1 [12 – 25]
2	1 – 2 [25 – 50]
3	1 – 3 [25 – 75]
4	2 – 4 [50 – 100]
5	2 – 5 [50 – 125]
6	3 – 6 [75 – 150]

B4 Coarse Aggregate (CA) Designation

Refer to the coarse aggregate designation for the range of optional coarse aggregates gradations allowed in the mix in accordance with Table 3137-4, "Coarse Aggregate Designation for Concrete," and Table 2461-6:

Table 2461-6 Coarse Aggregate Designation for Concrete	
Range	**Optional Coarse Aggregate Designation**
0	CA-00 only
1	CA-15 to CA-50, inclusive

2	CA-15 to CA-60, inclusive
3	CA-35 to CA-60, inclusive
4	CA-35 to CA-60, inclusive
5	CA-45 to CA-60, inclusive
6	CA-50 to CA-70, inclusive
7	CA-70 only
8	CA-80 only

B5 Additional Designations

For mix designs that require a specified class of coarse aggregate as defined in 3137.2.B, an additional letter will follow the fourth digit of the Mix Number such as "A" (Class A Aggregate Requirement).

The Engineer may identify special concrete mix designations with additional letters following the last digit such as "HE" (High Early), "WC" (Water-Cement Ratio), "HPC" (High Performance Concrete), "MS" (Microsilica), or others.

SB-23.2 MnDOT 2461.3E shall be deleted and replaced with the following:

E Concrete Admixtures.....3113

The Contractor may use the following approved admixtures at their discretion as listed on the Approved Products list:

(1) Type A, "Water Reducing and Mid Range Water Reducing Admixtures"
(2) Type B, "Retarding/Hydration Stabilizer Admixtures"
(3) Type D, "Water Reducing and Retarding Admixtures"
(4) Type S, "Viscosity Modifying Admixtures"

Use of any other admixtures in the concrete requires approval of the Concrete Engineer unless otherwise required by or allowed in the Contract.

When incorporating admixtures into the concrete:

(1) Use admixture dosage rates recommended by the manufacturer.
(2) Add all admixtures at the plant.
(3) Provide admixture additions at the job site that are the same products as originally incorporated into the mix.
(4) Use calcium chloride in concrete as approved by the Engineer, in conjunction with the Concrete Engineer. Do not use calcium chloride in units containing prestressing steel or in bridge superstructure concrete.

E1 Use of Additional Admixtures

On a case by case basis, the Engineer, in conjunction with the Concrete Engineer, will consider the use of the following admixtures, added either at the plant or at the job site, as listed on the Approved Products list:

(1) Type C, "Accelerating Admixtures"
(2) Type E, "Water Reducing and Accelerating Admixtures"
(3) Type F, "Water Reducing, High Range Admixtures"
(4) Type G, "Water Reducing, High Range and Retarding Admixtures"

E1a Delivery Time Beyond 90 Minutes

If the haul time does not facilitate mixing and placing the concrete within 90 minutes, perform the following procedures for pre-qualifying a concrete mix to extend the delivery time to 120 minutes. Extending the delivery time beyond 120 minutes will require additional testing at 30 minute intervals up to the maximum desired delivery time as directed by the Concrete Engineer.

(1) Provide a contractor mix design in accordance with 2461.3G2 for each combination of materials.
(2) Specification 2461.3D is modified to allow up to 25% fly ash replacement for cement. All other requirements of 2461 apply.
(3) Laboratory trial batching on the proposed mix includes the following testing requirements:
    (a) Perform all laboratory trial batching at an AMRL accredited laboratory.
    (b) Perform all plastic concrete testing after adding all admixtures to the concrete mixture.
    (c) Perform slump, air content, unit weight and temperature testing immediately after batching and at 90 and 120 minutes.
    (d) Fabricate concrete cylinders for compressive strength at 90 and 120 minutes (sets of 3) and cylinders for hardened air content testing at 90 and 120 minutes (sets of 5).
    (e) Test the cylinders for compressive strength at 28 days.
    (f) Determine the hardened air content (ASTM C457) at a minimum of 7 days. The Contractor is required to test at 2 samples representing 90 minutes and 2 samples representing 120 minutes and provide MnDOT with the other 6 samples for testing at their discretion. Retain any hardened concrete test specimens for a minimum of 90 days for MnDOT to examine at their discretion.
    (g) Ensure the admixture manufacturer's technical representative is present during the trial batching.
    (h) Contact the MnDOT Concrete Engineering Unit a minimum of 2 days prior to mixing. This same 2 day notification is

required prior to any physical testing on hardened concrete samples.

(i) Once accepted by the Concrete Engineer, the laboratory trial batching is considered acceptable for use for 5 years, unless it is determined the material sources have changed significantly since the initial laboratory testing and acceptance. In all cases, the Engineer will require field trial batching on a project specific basis.

(4) Field trial batching on the proposed mix for each specific project shall include batching in the presence of the Engineer and the following:

(a) Provide a QC Plan for extending the delivery time beyond 90 minutes.

(b) Mix and transport the concrete using the same materials as were utilized in the laboratory trial batching.

(c) Batch a minimum 5 cu. yd (4 cu. m) of concrete utilizing the same methods intended for use when supplying concrete placed into the permanent work.

(d) Maintain the ready mix truck in transit; by either driving around the yard or on the roadway; and maintain the drum speed at 5 to 7 revolutions per minute for the entire 120 minutes.

(e) Perform all plastic concrete testing after adding admixtures to the concrete mixture.

(f) Perform slump, air content, unit weight and temperature testing at 90 and 120 minutes.

(g) Fabricate concrete cylinders for compressive strength at 90 and 120 minutes (sets of 3) and cylinders for hardened air content testing at 90 and 120 minutes (sets of 2).

(h) Test the cylinders for compressive strength at a minimum of 7 days.

(i) Determine the hardened air content (ASTM C457) at a minimum of 7 days. The Contractor is required to test 1 sample representing 90 minutes and 1 sample representing 120 minutes and provide MnDOT with the other 2 samples for testing at their discretion. Retain any hardened concrete test specimens for a minimum of 90 days for MnDOT to examine at their discretion.

(j) Incorporate the trial batch concrete into other work with the approval of the Engineer.

(k) The Contractor must demonstrate to the Engineer the ability to properly mix, control and place the concrete.

(5) The Concrete Engineer, in coordination with the Engineer, will review the trial batch results and all related concrete testing for compliance with the QC Plan and the Contract. Final approval of

the mixture is based on satisfactory field placement and performance.

SB-23.3 MnDOT 2461.3F shall be deleted.

SB-23.4 MnDOT 2461.3G, 2461.3H, and 2461.3J shall be deleted and replaced with the following:

G Job Mix Proportions

G1 Department Designed

The Department will provide the estimated composition of concrete mixes unless otherwise required by the Contract.

The Department may adjust the mix composition of the concrete without adjusting the Contract unit price for any items of work.

G1a Concrete Yield

The Department defines concrete yield as the ratio of the volume of mixed concrete, less accountable waste, to the planned volume of the work constructed. The Department will not assume responsibility for the yield from a given volume of mixed concrete.

G1b High-Early Strength Concrete

When the Engineer requires high-early strength concrete, the concrete is designed in accordance with the following:

- Increasing the cement content of the concrete up to 30 percent and/or using an approved accelerator as allowed by the Engineer, in conjunction with the Concrete Engineer
- Using 100 percent portland cement unless allowed by the Contract or the Engineer
- A maximum cement content for a cubic yard [cubic meter] of concrete not to exceed 900 lb [**535 kg**].
- A w/c ratio not to exceed 0.38 for Type 3 Concrete unless specified elsewhere in the Contract.

G2 Contractor Designed

Design the concrete mix based on an absolute volume of 27.00 cu. ft ± 0.10 cu. ft [**1.000 cu. m ± 0.003 cu. m**] for the following:

(1) Concrete paving mixes in accordance with 2301,

(2) Concrete mixes with an anticipated or required 28-day compressive strengths of at least 5,000 psi [**34 Mpa**],
(3) Precast concrete in accordance with 2405, 2412, 3236, 3238, 3621, 3622, 3630, 3661, and 3667
(4) Colored concrete
(5) Stamped concrete
(6) Cellular Concrete Grout – Controlled Low Strength Material (CLSM)
(7) Extended Delivery Times Beyond 90 minutes
(8) Concrete as otherwise required by the Contract.

Submit the concrete mixes utilizing the MnDOT Contractor Mix Design Submittal Package available on the Department's website at least 21 calendar days before initial placement of the concrete mix. The Concrete Engineer will provide specific gravity and absorption data for mix design calculations.

The Concrete Engineer will review the mix design submittal and approve the materials and mix design for compliance with the Contract.

The Contractor assumes full responsibility for the mix design and performance of the concrete.

The Engineer determines final acceptance of concrete for payment based on satisfactory field placement and performance.

SB-23.5 MnDOT 2461.4A2(c) shall be deleted and replaced with the following:

Do not place concrete when the air temperature at the point of placement is below 36 °F [2 °C] or is expected to fall below 36 °F [2 °C] within the following 24 h period unless approved cold-weather provisions are in-place. Discontinue concrete placement if the air temperature falls below 36 °F [2 °C].

SB-23.6 MnDOT 2461.4A4a shall be deleted and replaced with the following:

A4a Consistency

The Engineer will test the concrete for consistency using the slump test during the progress of the work. The Department may reject concrete batches with consistencies outside of the slump range in accordance with Table 2461-10. If any test shows the slump in excess of the upper limit of the slump range, the Engineer will reject the concrete represented by that test unless the Contractor makes adjustments to the concrete before use.

Adjust the slump within the allowable range to optimize both placement and finishing.

If not using a Department approved Type A water reducer at the manufacturer's recommended dosage rates listed on the Approved Products list, meet the slump values for the slump range without water reducer in accordance with Table 2461-10.

If using a Department approved Type A water reducer at the manufacturer's recommended dosage rates listed on the Approved Products list, meet the slump values for the slump range with water reducer in accordance with Table 2461-10.

Table 2461-10
Slump Range Designation

Slump Designation	Slump Range without Water Reducer, *in [mm]*	Slump Range with Water Reducer, *in [mm]*
1	½ – 1 **[12 – 25]**	½ – 1 **[12 – 25]**
2	1 – 2 **[25 – 50]**	1 – 3 **[25 – 75]**
3	1 – 3 **[25 – 75]**	1 – 4 **[25 – 100]**
4	2 – 4 **[50 – 100]**	2 – 5 **[50 – 125]**
5	2 – 5 **[50 – 125]**	2 – 6 **[50 – 150]**
6	3 – 6 **[75 – 150]**	3 – 7 **[75 – 175]**

Contact the Engineer if encountering unusual placement conditions that render the specified slump range unsuitable. The Department will provide mix composition modifications to provide the desired change in consistency while maintaining the other specified properties of the concrete mix. Do not add water solely to temporarily facilitate the placement of concrete.

A4a(1) Concrete Placed by the Slip-Form Method

Place concrete that does not slough and is adequately consolidated at a slump value that optimizes placement for the designated mixture.

A4a(2) Non-Conforming Material

Only place concrete meeting the slump requirements in the work. If the Contractor places concrete not meeting the slump requirements into the work, the Engineer will not accept nonconforming concrete at the Contract unit price.

For concrete not meeting the required slump, the Engineer will make determinations regarding the disposition, payment, or removal. The Department will adjust the Contract unit price for the Contract pay item of the concrete in accordance with Table 2461-11A, 2461-11B, 2461-11C and 2461-11D. When there is not a separate Structural Concrete bid price for an item of work or the concrete is a minor component of the unit bid price, the Department will reduce payment based on a concrete price of $100.00 per cu. yd [$130.00 per cu. m] or Contractor-provided invoice amount for the concrete in question, whichever is less.

Table 2461-11A General Concrete*	
Outside of Slump Range	**Adjusted Contract Unit Price**
Below slump range*	The Department will pay 95 percent of the relevant Contract unit price for materials placed as approved by the Engineer.
≤1½ in [**40 mm**] above slump range	The Department will pay 75 percent of the relevant Contract unit price for materials placed as approved by the Engineer.
1¾ in [**45 mm**] – 2¼ in [**55 mm**] above slump range	The Department will pay 50 percent of the relevant Contract unit price for materials placed as approved by the Engineer.
> 2¼ in [**55 mm**] above slump range	The Department will pay 25 percent of the relevant Contract unit price for materials placed as approved by the Engineer
* If the Contractor places piling or footing concrete below the slump range, the Department will deduct $100 per cu. yd [**$130 per cu. m**] or a Contractor-provided invoice amount to the relevant Contract unit price of the concrete represented by the slump test, whichever is less. The Department will not reduce Contract unit price for low slump concrete placed with the slip-form method as approved by the Engineer.	

Table 2461-11B Bridge Deck Concrete	
Outside of Slump Range	**Adjusted Contract Unit Price**
Below slump range	The Department will pay 95 percent of the relevant Contract unit price for materials placed as approved by the Engineer.
≤1½ in [**40 mm**] above slump range	The Department will pay 75 percent of the relevant Contract unit price for materials placed as approved by the Engineer.
> 1½ in [**40 mm**] above slump range	The Department will pay 25 percent of the relevant Contract unit price for materials placed as approved by the Engineer.

Table 2461-11C Low Slump Bridge Deck Concrete From ½ in [12 mm] to 1 in [25 mm]	
Outside of Slump Range	**Adjusted Contract Unit Price**
Below slump range	No deduction for materials placed as approved by the Engineer
≤½ in [**12 mm**] above slump range	The Department will pay 50 percent of the relevant Contract unit price for materials placed as approved by the Engineer.
> ½ in [**12 mm**] – ¾ in [**20 mm**] above slump range	The Department will not pay for concrete placed but will allow the concrete to remain in place as approved by the Engineer.
> ¾ in [**20 mm**] above slump range	The Department will not pay for concrete. Provide additional testing as directed by the Engineer to determine if the concrete can remain or place or is subject to removal and replacement.

Table 2461-11D Low Slump Concrete — Patching From ½ in [12 mm] to 1 in [25 mm]	
Outside of Slump Range	**Adjusted Contract Unit Price**
Below slump range	No deduction for materials placed as approved by the Engineer
≤½ in [**12 mm**] above slump range	The Department will pay 75 percent of the relevant Contract unit price for materials placed as approved by the Engineer.
≥¾ in [**20 mm**] above slump range	The Department will pay 25 percent of the relevant Contract unit price for materials placed as approved by the Engineer.

SB-23.7 MnDOT 2461.4A4b shall be deleted and replaced with the following:

A4b Air Content

Maintain the air content of Type 3 general concrete at the specified target of 6.5.percent ±1.5 percent of the measured volume of the plastic concrete in accordance 1503.

Make any adjustments immediately to maintain the desired air content.

Measure the air content at the point of placement but before consolidation.

A4b(1) Non-Conforming Material

Only place Type 3 concrete meeting the air content requirements in the work. If the Contractor places Type 3 concrete not meeting the air content requirements into the work, the Engineer will not accept nonconforming concrete at the Contract unit price.

For concrete not meeting the required air content, the Engineer will make determinations regarding the disposition, payment, or removal. The Department will adjust the Contract unit price for the Contract pay item of the concrete in accordance with Table 2461-17. When there is not a separate Structural Concrete bid price for an item of work or the concrete is a minor component of the unit bid price, the Department will reduce payment based on a concrete price of $100.00 per cu. yd [**$130.00 per cu. m**] or the Contractor-provided invoice amount for the concrete in question, whichever is less.

General Concrete (Target Air Content 6.5%)	
Air Content, %	**Adjusted Contract Unit Price**
> 10.0	The Department will pay 75 percent of the relevant Contract unit price for the concrete represented for material placed as approved by the Engineer.
>8.0 – 10.0	The Department will pay 95 percent of the relevant Contract unit price for the concrete represented for material placed as approved by the Engineer.
5.0 – 8.0	The Department will pay 100 percent of the relevant Contract unit price for the concrete represented, for material placed as approved by the Engineer.
>4.0 – <5.0	The Department will pay 75 percent of the relevant Contract unit price for the concrete represented for material placed as approved by the Engineer.
>3.5 – 4.0	The Department will pay 25 percent of the relevant Contract unit price for the concrete represented and placed as approved by the Engineer. If the Engineer, in conjunction with the Concrete Engineer, determines the surface is exposed to freeze-thaw cycling, coat the concrete with an approved epoxy penetrant sealer from the MnDOT Approved Products list.
≤3.5	Remove and replace concrete in accordance with 1503, "Conformity with Plans and Specifications" and 1512, "Unacceptable and Unauthorized Work" as directed by the Engineer. If the Engineer, in conjunction with the Concrete Engineer, determines the concrete can remain place, the Engineer will not pay for the concrete and if the Engineer determines the surface is exposed to salt-brine freeze-thaw cycling, coat with an approved epoxy penetrant sealer from the MnDOT Approved Products list.

SB-23.8 MnDOT 2461.4A5 shall be deleted and replaced with the following:

A5 Test Methods and Specimens

The Engineer will furnish molds for the test specimens in accordance with the following based on the maximum aggregate size:

(1) 4 in × 8 in [**100 mm × 200 mm**] cylinder molds,
(2) 6 in × 12 in [**150 in × 300 mm**] cylinder molds for maximum aggregate sizes greater than 1¼ in [**31.5 mm**],
(3) 6 in × 6 in × 20 in [**150 in × 150 in × 500 mm**] beam molds, use other beam mold sizes as approved by the Engineer.

Provide curing tanks of adequate size and number for curing all of the concrete test specimens in accordance with 2031.3.C. Supply the curing tanks with heaters to maintain a water temperature of 73° F ± 3° F [**23° C ± 2° C**].

If Contractor testing is required in the Contract, perform the following:

(1) Provide a MnDOT Certified Concrete Field 1 Technician to perform all Contractor Testing.

(2) Determine the required testing rates in accordance with the Schedule of Materials Control,
(3) Take samples after the first ¼ cu yd [cu. m] and before discharging the last ¼ cu. yd [**cu. m**] of the batch,
(4) Perform concrete sampling and testing meeting the requirements of the MnDOT Concrete Manual,
(5) Measure slump and air content, and make strength specimens when placing the concrete,
(6) Record field measurements, including strength specimen identifications on MnDOT Form 2448, *Weekly Concrete Report*, to provide to the Concrete Engineer.

The Engineer will transport the cylinders to the Agency laboratory for testing.

A5a Standard Strength Cylinders

The Department will perform the following for standard strength cylinders:

(1) Cast cylinders for testing at 28 days,
(2) Mark cylinders for identification of the represented unit or section of concrete,
(3) Cure the cylinders meeting the requirements of the MnDOT Concrete Manual, and
(4) Submit cylinders and a completed cylinder identification card to the Agency laboratory.

The Producer of precast units is responsible for casting standard strength cylinders.

A5b Control Strength Cylinders

The Engineer will use control cylinders to determine when the sequence of construction operations is dependent upon the rate of concrete strength development. The Engineer will cast enough control cylinders to determine when the concrete attains the required strength for all desired control limitations.

The Department will perform the following for control strength cylinders:

(1) Cast up to three (3) control cylinders. Any additional control cylinders are the responsibility of the Contractor,
(2) Cure the cylinders in the same location and under the same conditions as the concrete structure or unit involved meeting the requirements of the Concrete Manual,
(3) Mark control cylinders for identification of the represented unit or section of concrete, and

(4) Submit cylinders and a completed cylinder identification card to the Agency laboratory.

If the Agency is unavailable to test the control cylinders, the Contractor shall submit the control cylinders to an independent testing facility for testing or the Contractor may perform the testing on the control cylinders on a portable mechanical or hydraulic testing machine checked and calibrated with a standard proving ring as approved by the Engineer and in the presence of the Engineer.

The Producer of precast units is responsible for casting control strength cylinders.

A5c Strength Specimens for Concrete Paving

Use flexural beams to determine strength or provide cylinders as allowed by the Contract or approved by the Engineer.

Cast standard beams or cylinders for testing at 28 days.

Cast a sufficient number of control beams or cylinders to determine when the concrete attains the required strength for all desired control limitations.

Cure the standard beams or cylinders meeting the requirements of the MnDOT Concrete Manual.

Cure the control beams or cylinders in the same location and under the same conditions as the concrete structure or unit involved meeting the requirements of the MnDOT Concrete Manual.

The Engineer will test the flexural beams and record the results on MnDOT Form 2162, "*Concrete Test Beam Data*."

If using cylinders, the Engineer will submit cylinders and a completed identification card to the Agency laboratory.

SB-23.9 MnDOT 2461.4D1 shall be deleted and replaced with the following:

D Certified Ready-Mix Concrete

D1 Definition

The Department defines ready-mix concrete as one of the following:

(1) Central-mixed concrete proportioned and mixed in a stationary plant and hauled to the point of placement in revolving drum agitator trucks or a truck mixer, or

(2) Truck-mixed concrete proportioned in a stationary plant and fully mixed in truck mixers.

Commonly uses certified ready-mix terms are defined in the following:

Certified Ready-Mix Terminology	
Term	Definition
Mix design water	The maximum allowable water content for 1 cu. yd [**1 cu. m**] of concrete in accordance with MnDOT Form TP 02406, *Estimated Composition of Concrete Mixes*.
Total moisture factor	Factor used to determine total amount of water carried by a given wet aggregate.
Absorption factor	Factor used to determine the water contained within the pores of the aggregate and is held within the particles by capillary force.
Free moisture	The water that is carried on the surface of the aggregate that becomes part of the total water.
Batch water	Water actually batched into the truck by the batcher.
Total water	Batch water added to free moisture. Total water may also include the water used in diluting admixture solutions.
Temper water	Water added in mixer to adjust slump.
Total actual water	The water in the concrete mixture at the time of placement from any source other than the amount absorbed by the aggregate. It includes all batch water placed in the mixer, free moisture on the aggregate and any water added to the ready mix truck prior to placement.
Ready-Mix Producer or "Producer"	Party that is producing the concrete for the Contract. It is understood that the Ready-Mix Producer is the agent of the Contractor.

SB-23.10 MnDOT 2461.4D2 shall be deleted and replaced with the following:

D2 General Requirements

Supply all ready-mix concrete from MnDOT Certified Concrete Plants in accordance with 2461.4D7.

The Engineer will reject ready-mix concrete delivered to the work site not meeting the specified requirements for delivery time, consistency, quality, air content, or other properties as unacceptable work in accordance with 1512, "Unacceptable and Unauthorized Work."

Provide batches for a delivered load of concrete in sizes of at least 1 cu. yd [**1 cu. m**].

Handle washout water in accordance with 1717.

SB-23.11 MnDOT 2461.4D3 shall be deleted and replaced with the following:

D2 Notice of Inspection

Notify the Engineer at least 24 h before beginning concrete production to allow the Engineer time to provide inspection forces needed for the work and to approve preparations for concrete placement. If the Contractor fails to provide 24 h notice, the Engineer may delay concrete placement in accordance with 1503, "Conformity with Plans and Specifications" and 1512, "Unacceptable and Unauthorized Work."
If the producer needs to change plants during placement, notify the Engineer and obtain approval before changing the plant.

SB-23.12 The first two paragraphs of MnDOT 2461.4D5c shall be deleted and replaced with the following:

D5c Mixing In Truck Mixer

Charge the materials into the truck mixer drum by introducing sufficient water before adding solid materials. Perform charging operations without losing materials.

Leave the truck mixer at the plant site for a minimum of 5 minutes or 50 revolutions during the mixing period. Transport the concrete at agitating speed to the point of placement.

SB-23.13 MnDOT 2461.4D6 shall be deleted and replaced with the following:

If using a Department approved Type A, "Water reducing or Mid Range Water Reducing Admxiture" at the manufacturer's recommended dosage rates listed on the Approved Products list, meet the slump values for the slump range with water reducer in accordance with Table 2461-10.

D6 Delivery Requirements

Place concrete into the work in accordance with the following:

(1) Type 1 Concrete – within 90 minutes of batching, and
(2) Type 3 Concrete – within 90 minutes of batching when all admixtures are added at the plant at the manufacturer's recommended dosage rates listed on the Approved Products list. If the haul time does not facilitate mixing and placing the concrete within 90 minutes, test the concrete in accordance with 2461.3E1a.

In any case, do not add additional mixing water once the concrete is 60 minutes old.

Mix the load a minimum of 5 minutes or 50 revolutions at mixing speed after addition of any admixture.

The Contractor may transport Type 3 concrete in non-agitating equipment if the concrete is discharged within 45 minutes of batching.

Batch time starts when the batch plant or the transit mix truck adds the cement to the other batch materials.

D6a Field Adjustments

The Engineer will test the concrete for compliance with 2461.4A4a and 2461.4A4b according to the following:

(1) If the first test taken by the Engineer passes, the Engineer will resume verification testing according to the Schedule of Materials Control.
(2) If the first test taken by the Engineer fails, make adjustments and perform any quality control testing prior to the Engineer performing a final test. Acceptance or rejection of the truck is based on the Engineer's final test result.
(3) The Engineer will test up to 2 additional trucks according to 2461.4D6a(1) and 2461.4D6a(2).
(4) If the concrete is not within specification after the first 3 trucks, the Engineer will reduce their verification testing rate to once per truck for acceptance.
(5) Once the Engineer returns to normal verification testing according to the Schedule of Materials Control and a failing test occurs, the Engineer will repeat 2461.4D6a(2), 2461.4D6a(3) and 2461.4D6a(4).

SB-23.14 MnDOT 2461.4D7 shall be deleted and replaced with the following:

D7 Certified Ready-Mix Plant Program

Provide ready-mix concrete produced by a certified ready-mix plant. Perform quality control of concrete production under a certification program for ready-mix concrete plants.

Complete all concrete plant documentation utilizing the Concrete Ready-mix Plant QC Workbook available from the MnDOT Concrete Engineering website. Electronically submit the QC Workbook to the Engineer by the Tuesday immediately following the previous week's production.

D7a Plant Certification

Before concrete production each season, ensure the producer performs the following:

(1) Performs an on-site inspection at the concrete plant with the Engineer who completes a MnDOT Form 2163, *Concrete Plant Contact Report*.
(2) Signs the report certifying compliance with the Certified Ready-Mix requirements and continual maintenance of the plant. The Engineer will also sign MnDOT Form 2163, *Concrete Plant Contact Report*.
(3) Provides a copy of the current MnDOT Concrete Manual and retain on-site.
(4) Equips the Certified Ready-Mix Plant with a working facsimile machine or an email address.
(5) Keeps plant reports, charts, and supporting documentation on file at the plant site for 5 calendar years.
(6) Provides electronic scales for weighing all materials.

D7b Sampling and Testing

Provide a MnDOT Certified Concrete Plant Level 2 Technician to oversee testing and plant operations and to remain on-site during concrete production or have cellular phone capability.

Provide facilities in accordance with 1604 for the use of the plant technician in performing tests.

Ensure the producer provides technicians with certification at least meeting MnDOT Concrete Plant Level 1 to perform all of the duties in accordance with the MnDOT Concrete Manual. The Engineer will provide technicians with certification at least meeting MnDOT Concrete Plant Level 1 to perform all of the duties in accordance with the MnDOT Concrete Manual.

Ensure the producer performs testing in accordance with the MnDOT Concrete Manual and determines testing rates meeting the requirements of the Schedule of Materials Control. The Engineer performs testing in accordance with the MnDOT Concrete Manual and determines testing rates meeting the requirements of the Schedule of Materials Control.

Take samples randomly using ASTM D 3665, Section 5.

Perform testing at the certified ready-mix plant site. Perform additional testing as directed by the Engineer. The Engineer may oversee the quality control sampling process.

Provide equipment and perform calibrations meeting the requirements of the following:

(1) AASHTO T 27, "Sieve Analysis of Fine and Coarse Aggregates,"

(2) AASHTO T 255, "Total Moisture Content of Aggregate by Drying,"
(3) AASHTO M 92, "Wire-cloth Sieves for Testing Purpose," and
(4) AASHTO M 231, "Weighing Devices Used in the Testing of Materials."

D7c Gradations and Aggregate Quality

Determine the gradation of the fine aggregates and the coarse aggregates as required by the Contract. Use mechanical shakers for sieve analysis of fine and coarse aggregates.

Identify quality control companion samples with the following information:

(1) Date,
(2) Test number,
(3) Time,
(4) Type of material,
(5) Plant, and
(6) Sampling location.

Document gradation results on MnDOT Form 2449, *Weekly Concrete Aggregate Report*.

Chart the results of all producer and Department gradation results of the coarse aggregate and the No. 8 [**2.36 mm**], No. 30 [**600 µm**], and No. 50 [**300 µm**] sieves of the fine aggregate.

The producer may request a reduction in testing rates as approved by the Engineer, in conjunction with the Concrete Engineer.

If the gradation tests on split samples from quality control or verification samples result in a variation between the producer and the Department greater than that set forth in the table below, the parties shall follow the procedures for test result dispute resolution available from the MnDOT Concrete Engineering website.

Allowable Variations on Percent Passing Sieves	
Sieve Size	**Allowed Percentage**
2 in [**50 mm**] – ⅜ in [**9.5 mm**]	± 6
No. 4 [**4.75 mm**] – No. 30 [**600 µm**]	± 4
No. 50 [**300 µm**]	± 3
No. 100 [**150 µm**]	± 2
No. 200 [**75 µm**]	± 0.6

D7c(1) Non-conforming Material

Only place concrete meeting the gradation requirements in the work. If the Contractor places concrete not meeting the gradation requirements into the work, the Engineer will not accept nonconforming concrete at the Contract unit price.

For concrete not meeting the required gradation, the Engineer will make determinations regarding the disposition, payment, or removal. The Department will adjust the Contract unit price for the Contract pay item of the concrete in accordance with Table 2461-9 and 2461-10. When there is not a separate Structural Concrete bid price for an item of work or the concrete is a minor component of the unit bid price, the Department will reduce payment based on a concrete price of $100.00 per cu. yd [**$130.00 per cu. m**] unless an invoice amount for the concrete in question is provided, whichever is greater.

Table 2461-7A
General Concrete for Individual Aggregate Fractions
Fine and Coarse Aggregate Specification Sieves other than Fine Aggregate No. 200 [75 µm]

Outside of Specification, %	Adjusted Contract Unit Price
≤3	The Department will pay 98 percent of the relevant Contract unit price for concrete placed as approved by the Engineer.
4 to 6	The Department will pay 95 percent of the relevant Contract unit price for concrete placed as approved by the Engineer.
7 to 10	The Department will pay 90 percent of the relevant Contract unit price for concrete placed as approved by the Engineer.
> 10	The Department will pay 75 percent of the relevant Contract unit price for concrete placed as approved by the Engineer.

Table 2461-7B
General Concrete for No. 200 [75 µm] Sieve of Fine Aggregate

Outside of Specification, %	Adjusted Contract Unit Price
≤0.3	The Department will pay 98 percent of the relevant Contract unit price for concrete placed as approved by the Engineer.
0.4 to 0.6	The Department will pay 95 percent of the relevant Contract unit price for concrete placed as approved by the Engineer.
0.7 to 1.0	The Department will pay 90 percent of the relevant Contract unit price for concrete placed as approved by the Engineer.
> 1.0	The Department will pay for 75 percent of the relevant Contract unit price for concrete placed as approved by the Engineer.

If a failure occurs on the fine aggregate No. 200 [**75 µm**] sieve and on other sieves concurrently, the Department will only reduce the price based on the larger percentage deduction.

The Engineer, in conjunction with the Concrete Engineer, will determine adjusted Contract unit prices for coarse aggregate quality failures in accordance with 1503.

D7d Moisture Content

Ensure the producer performs the following:

(1) Determine the moisture content using the oven dry method in all fractions of the aggregate.
(2) Document moisture tests on MnDOT Form 2152, *Concrete Batching Report*.
(3) Chart the moisture content of each aggregate.

In addition to the oven dry moisture test, the producer may obtain the moisture content in the fine aggregate using a moisture probe.

To obtain approval for the use of a moisture probe, calibrate the moisture probe before each construction season meeting the requirements of the MnDOT Concrete Manual. Verify and chart both the probe moisture content and the oven-dry verification moisture test each week.

D7e Plant Diaries

Provide daily plant diaries in accordance with the MnDOT Concrete Manual using an approved form from the Department's website.

D7f Batch Weight Verification

The Engineer will observe the batching process to verify weights shown on the Certificate of Compliance.

The Engineer will observe the actual water batched during each collection of verification gradations in accordance with the following:

(1) Watching the ready-mix truck reverse the drum after washing,
(2) Verifying use of the current moisture test,
(3) Verifying that any additional water added to adjust the slump is recorded, and
(4) Validating water weights on the load batched and comparing the total water with the design water

The Engineer will document the actual water batched on MnDOT Form 24143, *Weekly Certified Ready-Mix Plant Report* and submit a copy to the Engineer to provide to the Concrete Engineer.

The Engineer will provide plant diaries in accordance with the MnDOT Concrete Manual.

D7g Certificate of Compliance

Provide a computerized Certificate of Compliance with each truckload of ready-mixed concrete at the time of delivery. The Department defines computerized to mean a document that records mix design quantities from load cells and meters.

If the computer that generates the Certificate of Compliance malfunctions, the Engineer may allow the Contractor to finish any pours in progress if the producer issues a handwritten MnDOT Form 0042, *Certificate of Compliance* with each load. Do not allow the producer to begin new pours without a working computerized Certificate of Compliance.

Provide a computerized Certificate of Compliance from the producer for each item of information, including the following:

(1) Name of the ready-mix concrete plant,
(2) Name of the Contractor,
(3) Date,
(4) State Project Number (SP) or (SAP),
(5) Bridge Number (when applicable),
(6) Time concrete was batched,
(7) Truck number,
(8) Quantity of concrete in this load,
(9) Running total of each type of concrete, each day for each project,
(10) Type of concrete (MnDOT Mix Designation Number),
(11) Cementitious materials using MnDOT Standard Abbreviations,
(12) Admixtures using MnDOT Standard Abbreviations
(13) Aggregate sources using 5 digit State Pit Numbers, and
(14) Admixture quantity fl. oz. per 100 pounds of cementitious **[mL per kg]** or oz per cu. yd **[mL per cu. m]**
(15) Batch information for materials using MnDOT standardized labels to represent each column shown in Table 2461-7C. Present the information in the order listed across the page (a through k) or print the information using two lines provided that the materials are identified in each line of information.

Table 2461-7C Standardized Certificate of Compliance Labels			
Category		**Formula**	**Standard Label**
a)	Ingredients (aggregate, cementitious, water, admixtures)	—	Ingredient
b)	Product Source (MnDOT Standard Abbreviation)	—	Source
c)	Total Moisture Factor (in decimals to 3 places)	—	MCFac
d)	Absorption Factor (in decimals to 3 places)	—	AbsFac
e)	MnDOT mix design oven dry (OD) weights, *lb/cu. yd* ***[kg/cu. m]***	—	OD
f)	Absorbed moisture in the aggregates, *lb/cu. yd* ***[kg/cu. m]***	(e × d)	Abs
g)	Saturated surface dry (SSD) weights for aggregates, *lb/cu. yd* ***[kg/cu. m]***)	(e + f)	SSD
h)	Free moisture, *lb/cu. yd* ***[kg/cu. m]***	(c - d) × e	Free Mst
i)	Target weights for one cubic yard [cubic meter] of concrete, *lb/cu. yd* ***[kg/cu. m]***	(g + h)	CY Targ **[CM Targ]**
j)	Target batch weights, *lb* ***[kg]***	(cu. yd × i) **[cu. m x i]**	Target
k)	Actual batch weights, *lb* ***[kg]***	—	Actual
NOTE: Actual cubic yards [**cubic meters**] batched may vary due to differences in air content, weight tolerances, specific gravities of aggregates, and other variables.			

(16) Total Water (Batch Water + Free Moisture) in pounds [kilograms]

(17) Water available to add [(Mix Design Water) × (Target CY (CM)) – Total water] in gallons [**liters**]

(18) Space to note the water adjustment information, including:

(18.1) Water in gallons [**liters**] added to truck at plant filled in by producer, enter zero (0) if no water is added.

(18.2) Water in gallons [**liters**] added to truck at the jobsite filled in by producer or Engineer, enter zero (0) if no water is added.

(18.3) Total actual water in pounds [**kilogram**] (Total Water from Certificate of Compliance plus any additions).

(19) **T**he following information printed with enough room beside each item to allow the Engineer to record the test results:

(19.1) Air content,

(19.2) Air temperature,

(19.3) Concrete temperature,

(19.4) Slump,

(19.5) Cylinder number,

(19.6) Location or part of structure,

(19.7) Time discharged, and

(19.8) Signature of Inspector.

(20) Location for the signature of the MnDOT Certified Plant 1 Technician representing the Producer. The technician will review the first Certificate of Compliance for each mix type, each day, for accuracy and hand sign the Certificate of Compliance at a location designated for signature signifying agreement to the terms of this policy and to certify that the materials itemized in the shipment comply with the specifications and plans.

D7h Decertification

If the Contractor provides concrete from a plant that cannot produce concrete that fails to perform testing, report accurate results, or complete required documentation, the Engineer may reject the concrete as unacceptable in accordance with 1503, "Conformity with Plans and Specifications" and 1512, "Unacceptable and Unauthorized Work.".

The Concrete Engineer, with coordination from the Engineer, may decertify the plant and halt production of concrete if the producer performs the following:

(1) Procedural changes made after the completion of the Concrete Plant Contact Report and after starting the work that cause non-compliance with the program,
(2) Continually produces concrete in non-compliance with this section,
(3) Completely disregards the requirements of this section, and
(4) Submits fraudulent test reports

If decertifying the plant, the Concrete Engineer may perform the following:

(1) Revoke plant certification.
(2) Revoke technician certification for individuals involved,
(3) Revoke bidding privileges as determined by the Construction Engineer, and
(4) Criminal prosecution for fraud as determined by the Attorney General.

SB-24 (2554) END TREATMENT - TANGENT TERMINAL

This work shall consist of constructing a commercial type energy absorbing terminal in accordance with MnDOT 2554, the details in the Plan, as recommended by the manufacturer, as directed by the Engineer, and the following:

SB-24.1 If the Contractor chooses to install either an ET-2000 or ET-2000 PLUS Energy Absorbing Terminal, it shall be of the type manufactured by Trinity Industries, Inc., Dallas, TX.

If steel posts are to be used they shall be steel breakaway posts as specified by the manufacturer.

The adhesive object marker is sold separately from the terminal and shall be incidental to Item 2554.523 (End Treatment – Tangent Terminal) for which no direct payment will be made. The object marker to use with the ET-2000 or ET-2000 PLUS is striped yellow and black.

SB-24.2 If the Contractor chooses to install an SKT-350 Sequential Kinking Terminal, the terminal shall be an SKT-350 of the type manufactured by Road Systems, Inc., Big Spring, TX.

The adhesive object marker is sold separately from the terminal and shall be incidental to Item 2554.523 (End Treatment - Tangent Terminal) for which no direct payment will be made. The object marker to use with the SK-350 is striped yellow and black.

SB-24.3 The Contractor is responsible for obtaining the most current details from the manufacturer. The Contractor shall provide one copy for the Engineer.

SB-25 (3137) COARSE AGGREGATE FOR PORTLAND CEMENT CONCRETE **(2011 Version (Rev. 4/27/11)) ◄DO NOT REMOVE THIS. IT NEEDS TO STAY IN FOR THE CONTRACTORS.**

MnDOT 3137 shall be deleted and replaced with the following:

SB-25.1 SCOPE

Provide coarse aggregate for use in portland cement concrete.

SB-25.2 REQUIREMENTS

A General

Provide coarse aggregate consisting of clean, sound, durable particles, uniform in quality, and free from wood, bark, roots, and other deleterious material.

The Engineer, in conjunction with the Concrete Engineer, may consider the following as the basis for acceptance of coarse aggregate for portland cement concrete:

(1) Results of laboratory tests,
(2) Behavior under natural exposure conditions,
(3) Behavior of other portland cement concrete with aggregate from the same or similar geological formations or deposits, and
(4) Any other tests or criteria as deemed appropriate by the Engineer, in conjunction with the Concrete Engineer.

B Classification

Provide coarse aggregate meeting the requirements of one of the following classifications:

(1) Class A: Crushed quarry rock including quartzite, gneiss, and granite, or mine trap rock including basalt, diabase, gabbro, and other igneous rock types. Class A aggregate may contain no greater than 4.0 percent non-Class A aggregate. The Department will not allow the intentional blending or adding of non-Class A aggregate.
(2) Class B: All other crushed quarry or mine rock types including carbonates, rhyolite, and schist.
(3) Class C: Natural or partly crushed gravel obtained from a natural gravel deposit.
(4) Class D: Mixture of at least two classes of coarse aggregate. The Engineer, in conjunction with the Concrete Engineer, will determine the suitability of the Class D aggregate for the proposed use including proportioning.
(5) Class R: Aggregate obtained from recycling concrete. The Engineer, in conjunction with the Concrete Engineer, will determine the suitability of the Class R aggregate for the proposed use including proportioning.

C Washing

Wash Class B, Class C, Class D, and Class R coarse aggregate. Wash Class A aggregate as needed to comply with the requirements of Table 3137-1.

D Quality

Quality requirements are based on each individual aggregate fraction unless otherwise allowed by the Engineer, in conjunction with the Concrete Engineer with the exception of the following:

(1) When 100 percent of the fractions from a single source pass the 1 in [25 mm] sieve, quality requirements are based on the composite value of the combined aggregates.
(2) When less than 100 percent of the fractions from a single source pass the 1 inch [25 mm] sieve:
    (a) Those fractions passing the 1 inch [25 mm] sieve are combined and based on the composite value;
    (b) The fractions greater than or equal to 1 inch [25 mm] are based on each individual aggregate fraction.

D1 Coarse Aggregate for General Use

Provide coarse aggregate for general use concrete in accordance with Table 3137-1.

Table 3137-1 Coarse Aggregate for General Use		
	Quality Test	Maximum Percent by Weight
(a)	Shale:	
	Fraction retained on the ½ in [12.5 mm] sieve	0.4
	Fraction retained on the No. 4 [4.75 mm] sieve, as a percentage of the total material	0.7
(b)	Soft iron oxide particles (paint rock and ochre)	0.3
(c)	Total spall materials*:	
	Fraction retained on the ½ in [12.5 mm] sieve	1.0
	Fraction retained on the No. 4 [4.75 mm] sieve, as a percentage of the total material	1.5
(d)	Soft particles‖	2.5
(e)	Clay balls and lumps	0.3
(f)	Sum of (c) total spall materials, (d) soft particles, and (e) clay balls and lumps†	3.5
(g)	Slate	3.0
(h)	Flat or elongated pieces‡	15.0
(i)	Quantity of material passing No. 200 [75 µm] sieve:	
	Class A and Class B aggregates#	1.5
	Class C and Class D aggregates§	1.0
(j)	Los Angeles Rattler, loss on total sample	40.0
(k)	Soundness of magnesium sulfate**	15.0

* Includes the percentages retained by shale and soft iron oxide particles, plus other iron oxide particles, unsound cherts, pyrite, and other materials with similar characteristics.
‖ Exclusive of shale, soft iron oxide particles, and total spall materials.
† Sum of the total spall materials, soft particles, and clay balls and lumps. For total spall materials, use the percent in the total sample retained on the No. 4 [4.75 mm] sieve.
‡ Thickness less than 25 percent of the maximum width. Length greater than 3 times the maximum width.
# Each individual fraction at the point of placement consists of dust from the fracture and free of clay or shale.
§ For each individual fraction at the point of placement.
** Loss at 5 cycles for any fraction of the coarse aggregate. Do not blend materials from multiple sources to obtain a fraction meeting the sulfate soundness requirement.

D2 Coarse Aggregate for Bridge Superstructure

Provide coarse aggregate in accordance with 3137.2D1 except as modified by Table 3137-2 for use in the following:

(1) Bridge superstructure (deck, railing, posts, curbs, sidewalks, and median strips);
(2) Approach panels; and
(3) Precast concrete panel facings for Mechanically Stabilized Earth walls.

Table 3137-2 Coarse Aggregate for Bridge Superstructure		
Quality Test		Maximum Percent by Weight
(a)	Shale:	
	Fraction retained on the ½ in [12.5 mm] sieve	0.2
	Fraction retained on the No. 4 [4.75 mm] sieve as a percentage of the total material	0.3
(b)	Soft iron oxide particles (paint rock and ochre)	0.2
(c)	Total spall materials*:	
	Fraction retained on the No. 4 [4.75 mm] sieve as a percentage of the total material	0.5
(d)	Soft particles‖	2.5
(e)	Clay balls and lumps	0.3
(f)	Sum of (c) total spall materials, (d) soft particles, and (e) clay balls and lumps, use the percent in the total sample retained on the No. 4 [4.75 mm] sieve	3.0
(g)	Absorption for Class B aggregate	1.75
(h)	Carbonate in Class C and Class D aggregates by weight	30.0
*	Includes the percentages retained by shale and soft iron oxide particles, plus other iron oxide particles, unsound cherts, pyrite, and other materials with similar characteristics.	
‖	Exclusive of shale, soft iron oxide particles, and total spall materials.	
†	Sum of the total spall materials, soft particles, and clay balls and lumps. For total spall materials, use the percent in the total sample retained on the No. 4 [4.75 mm] sieve.	

D3 Coarse Aggregate for Concrete Pavement

Provide coarse aggregate in accordance with 3137.2D1, except as modified by Table 3137-3, for use in the following:

(1) Concrete pavement, and
(2) Concrete pavement rehabilitation.

Table 3137-3 Coarse Aggregate for Concrete Pavement		
Quality Test		Maximum Percent by Weight
(a)	Absorption for Class B aggregate	1.75
(b)	Carbonate in Class C aggregate by weight	30.0

E Gradation

Provide coarse aggregate in accordance with Table 3137-4 including all sizes within the specified limits. The Department defines coarse aggregate as the uniform product of the producing plant, unless some sizes are removed to meet the gradation requirements. Do not use broken or noncontinuous gradations.

If the coarse aggregate has less than 100 percent passing the 1 in [25 mm] sieve, proportion the coarse aggregate using at least two fractions.

Gradation requirements are based on the composite value of the combined coarse aggregates.

Table 3137-4
Coarse Aggregate Designation for Concrete,
percent by weight passing square opening sieves

Aggregate	2 in [50 mm]	1½ in [37.5 mm]	1¼ in [31.5 mm]	1 in [25.0 mm]	¾ in [19.0 mm]	⅝ in [16.0 mm]	½ in [12.5 mm]	⅜ in [9.5 mm]	No.4 [4.75 mm]
CA-00	—	—	—	100	95 – 100	—	—	—	0 – 10
CA-15	100	95 – 100	—	—	35 – 65	—	—	5 – 25	0 – 7
CA-25	100	95 – 100	—	—	50 – 80	—	—	20 – 40	0 – 7
CA-35	—	100	95 – 100	—	55 –85	—	—	20 – 45	0 – 7
CA-45	—	—	100	95 – 100	65 – 95	—	—	25 – 55	0 – 7
CA-50	—	—	—	100	85 – 100	—	—	30 – 60	0 – 12
CA-60	—	—	—	—	100	85 – 100	—	40 – 70	0 – 12
CA-70	—	—	—	—	—	100	85 – 100	50 – 100	0 – 25
CA-80*	—	—	—	—	—	—	—	100	55 – 95

* Do not allow greater than 5 percent to pass the No. 50 [300 µm] sieve.

If producing Class R aggregate, remove reinforcing steel from the concrete and any concrete material passing the No 4 [4.75 mm] sieve.

SB-25.3 SAMPLING AND TESTING

Sample and test coarse aggregate fractions separately in accordance with Table 3137-5.

Table 3137-5
Preliminary Coarse Aggregate Testing

Aggregate	Notification and Testing Requirement
New source	Notify the Engineer at least 1 month before use. Perform new source concrete aggregate testing in accordance with the prodedure on the Department's website.
Previously tested aggregate	Notify the Engineer at least 2 weeks before use. Perform additional testing as directed by the Engineer, in conjunction with the Concrete Engineer.

Sample and test coarse aggregate in accordance with Table 3137-6.

Table 3137-6 Coarse Aggregate Test Methods	
Test	Testing Method
Sampling	MnDOT Concrete Manual
Sieve analysis	MnDOT Concrete Manual
Shale test	MnDOT Laboratory Manual 1207
Quantity of material passing the No. 200 [75 µm] sieve	MnDOT Concrete Manual
Specific gravity and absorption	MnDOT Laboratory Manual 1204
Density	AASHTO T 19 or MnDOT Laboratory Manual 1211
Los Angeles Rattler loss	AASHTO T 96
Void content	AASHTO T 19* or MnDOT Laboratory Manual 1211
Deleterious materials	MnDOT Laboratory Manual 1209
Soundness; magnesium sulfate	MnDOT Laboratory Manual 1219
Soft particles	MnDOT Laboratory Manual 1218
Flat or elongated pieces	ASTM D 4791
Clay balls or lumps	MnDOT Concrete Manual
* Base the void content on an oven-dry and compacted-by-rodding condition of the aggregate and a value of 62.4 lb per cu. ft [1,000 kg per cu. m] for water.	

SB-26 (3391) FASTENERS

Delete the contents of 3391.2B and substitute the following:

Provide field and shop bolts for steel bridges meeting the requirements of ASTM A325, Type 3 bolts. Provide bolts that project through the nut not less than ⅛ in (**3 mm**) nor more than ⅜ in (**10 mm**). Provide field and shop nuts for steel bridges that meet ASTM A 563/A 563M, Grade C3 or DH3 nuts and shop washers for steel bridges that meet ASTM F436/F 436M, Type 3 washers.

Provide bolts, nut, and washers that will be completely installed before application of the prime coat, in the uncoated "Black" condition. The bolts are to receive the same paint coatings as the structural steel. Provide mechanically galvanized fasteners that are to be field installed after the application of the prime coat, in accordance with ASTM B 695, Class 50, Type 1.

For all other bridges and structures, provide bolts that meet ASTM A 325, Type 1 (for painted and/or galvanized applications) or Type 3 (for unpainted weathering steel applications). Provide bolts that project through the nut no less than ⅛ in (**3 mm**) or more than ⅜ in (**10 mm**). Provide nuts that meet ASTM A 563/A 563M and washers that meet ASTM F 436/F 436M.

Bolts meeting ASTM A 325 may only be retightened once.

At the time of installation of fasteners, lubricate all nuts regardless of their specified finish with a lubricant of contrasting color as per ASTM A 563 Supplementary requirements S1, S2, and S3.

SB-26.1 Delete the first two sentences of 3391.2E and add the following:

Provide stainless steel bolts made of material meeting the requirements of ASTM F 593, for Condition CW1, Type 304, Type 316, or Type 316L. Provide finished bolts with the following characteristics:

(1) A yield strength of at least 60,000 psi [**415 MPa**],
(2) An ultimate tensile strength of 95,000 psi [**660 MPa**], and
(3) A minimum elongation of 20 percent in 2 in [**50 mm**].

Provide stainless steel nuts made of material meeting the requirements of ASTM F 594, Condition CW1, Type 304, 316, or 316L.

SB-27 (3401) FLANGED CHANNEL SIGN POSTS

The provisions of MnDOT 3401 are hereby modified and/or supplemented with the following:

SB-27.1 The last sentence of MnDOT 3401.2A Material, is hereby revised to read as follows:

The steel shall conform to the mechanical requirements of ASTM A 499, Grade 420 (**60**) and to the chemical requirements of ASTM A 1 for rails having nominal mass of 45 kg per m [**91 pounds per yard**] of length or heavier.

SB-27.2 MnDOT 3401.2C Mass, is hereby deleted and the following substituted therefor:

C Mass (Weight)

The nominal mass (**weight**) of the posts shall be as specified in the Plans, 3.0, 3.7, 4.1, 4.5, or 6.0 kg/m (**2.0, 2.5, 2.75, 3.0, or 4.0 pounds per foot**) of length, before punching and exclusive of galvanizing, anchor plates, and other attachments. A variation up to 5 percent under the specified mass (**weight**) will be permitted.

SB-27.3 MnDOT 3401.2D, Shape and Dimensions, is hereby deleted and the following substituted therefor:

D Shape and Dimensions

The posts shall be of channel section design with flanges against which the sign will be placed. The front face of the flanges shall be flat and in the same plane so as to provide smooth, uniform bearing for the sign. The back of the flanges and the

posts shall be flat and parallel to the front. The cross section of the posts shall be symmetrical about the central axis perpendicular to the front and back.

The posts shall be straight, free from excessive bow, twist, and other injurious or unsightly defects.

SB-27.4 Table 3401-1 is hereby deleted and the following substituted therefor:

TABLE 3401-1
NOMINAL DIMENSIONS

Mass per Unit of Length	3.0 kg **(2.0 pound)**	3.7 kg **(2.5 pound)**	4.1 kg **(2.75 pound)**	4.5 kg **(3.0 pound)**	6.0 kg **(4.0 pound)**
Wide overall across front	76 mm **(3 inches)**	76 mm **(3 inches)**	76 mm **(3 inches)**	83 mm **(3¼ inches)**	89 mm **(3½ inches)**
back surface	25 mm **(1 inch)**	25 mm **(1 inch)**	25 mm **(1 inch)**	32 mm **(1¼ inches)**	32 mm **(1¼ inches)**
flanges (bearing surface)	13 mm **(½ inch)**	13 mm **(½ inch)**	13 mm **(½ inch)**	16 mm **(⅝ inch)**	19 mm **(¾ inch)**
Depth overall, front to back	35 mm **(1⅜ inches)**	35 mm **(1⅜ inches)**	38 mm **(1½ inches)**	38 mm **(1½ inches)**	43 mm **(1.7 inch)**
Thickness of Metal, Flanges & Back	3 mm **(1/8 inch)**	3 mm **(1/8 inch)**	5 mm **(3/16 inch)**	4 mm **(0.16 inch)**	5 mm **(0.20 inch)**
Sides	3 mm **(1/10 inch)**	3 mm **(1/8 inch)**	3 mm **(1/8 inch)**	4 mm **(0.15 inch)**	4 mm **(0.15 inch)**

NOTE: Dimension requirements are for flat flange sections.

BIDDER MUST FILL IN UNIT PRICES IN NUMERALS; MAKE EXTENSION FOR EACH ITEM AND TOTAL. FOR COMPLETE INFORMATION CONCERNING THESE ITEMS, SEE PLANS AND SPECIFICATIONS, INCLUDING SPECIAL PROVISIONS.

SPECIFICATION OR ITEM NO.	ITEM DESCRIPTION	UNIT OF MEASURE	APPROX QUANTITIES	UNIT PRICE		AMOUNT	
				DOLLARS	CTS.	DOLLARS	CTS.
2021.501	MOBILIZATION	LUMP SUM	1				
2105.522	SELECT GRANULAR BORROW MOD 10% (CV)	CU YD	3480				
2105.604	GEOSYNTHETIC REINFORCEMENT TYPE 1	SQ YD	15430				
2105.604	GEOSYNTHETIC REINFORCEMENT TYPE 2	SQ YD	2000				
2211.503	AGGREGATE BASE (CV) CLASS 5 MODIFIED	CU YD	415				
2360.503	TYPE SP 12.5 WEARING COURSE MIXTURE (2, B) 4" THICK	SQ YD	952				
2401.513	TYPE SPECIAL BARRIER CONCRETE (3Y46A)	LIN FT	165				
2401.541	REINFORCEMENT BARS (EPOXY COATED)	POUND	2890				
2401.601	SLOPE PREPARATION	LUMP SUM	1				
2401.601	STRUCTURE EXCAVATION	LUMP SUM	1				
2405.603	PRESTRESSED CONCRETE BOX BEAMS 33x48	LIN FT	661				
2411.604	CONCRETE MASONRY WALL	SQ FT	4251				
2514.503	AGGREGATE SLOPE PAVING	SQ YD	160				
2554.501	TRAFFIC BARRIER DESIGN SPECIAL	LIN FT	100				
2554.501	TRAFFIC BARRIER DESIGN B8338	LIN FT	100				
2554.523	END TREATMENT-TANGENT TERMINAL	EACH	4				

TOTAL: $_____